CUTTING PRO

FC2230 SERIES

MANUAL NO. FC2230-UM-251

SERVICE MANUAL

GRAPHTEC CORPORATION

FC2230-UM251-02-1600

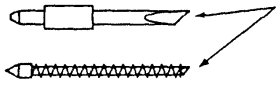
Manual Update Index

No.	日　付	変　更　内　容	頁	版 数
1	1998/1/14			01

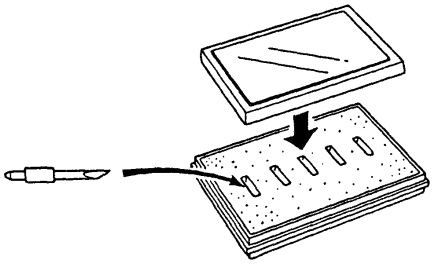
WARNING

This product uses a cutting blade. To prevent injuries (when replacing the cutter blade, installing the cutter pen, etc.), take the following precautions when handling the cutter blade.

- Cutter blade

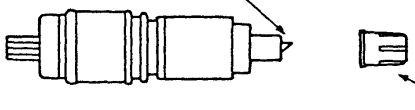


The blades are sharp. Be careful not to cut your fingers or prick yourself when handling the cutter.
Return used blades to the accessory cutter blade case and throw them all out together when the whole case has been filled.



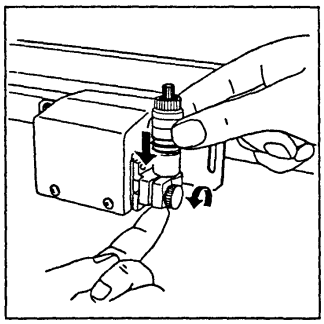
- Cutter pen

The tip consists of a sharp blade. Do not extend it too far. When it is not in use, cover it with the protective cap supplied. The methods for extending the blade and replacing it are described in Chapter 3 of this manual.



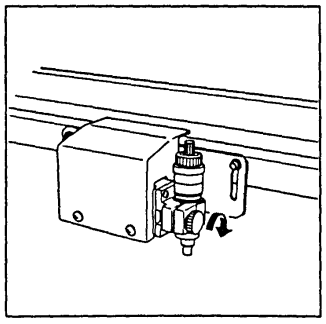
Protective cap

- When installing the cutter pen, push it in all the way to the pen stopper section as illustrated in the figure below, and tighten the screw securely. After the power has been turned on, and during operation, do not touch the pen tip. It is dangerous.



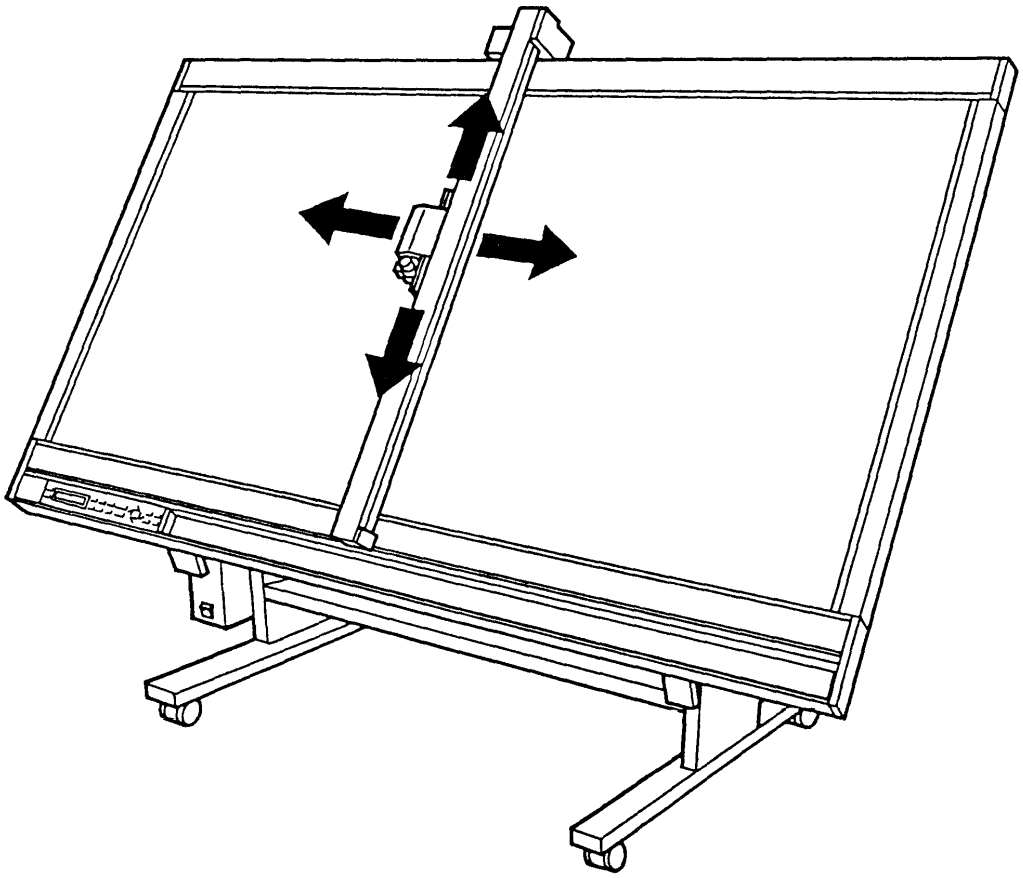
(1) Loosen the pen holder screw.

(2) While raising the pen holder, push the cutter pen all the way to the pen stopper section.



(3) When the pen has been mounted, tighten the screw.

- During operations, immediately after completion of operations, and when setting cutting plotter functions, the pen carriage, Y bar, and other parts which are not fixed, may move suddenly. Do not let your hands, hair, or clothing get too close to the moving parts or within their range of movement. Do not place any foreign objects in or near these areas either. If your hands, hair, clothing, or the like get caught in, or wrapped around moving parts, you may be injured and the machine may be damaged.



CONTENTS

1. INTRODUCTION

1.1 Model Names and Basic Specifications 1-1
1.2 Accessories 1-2
1.3 Features 1-3
1.4 Usage Precautions 1-5
1.5 Daily Maintenance and Storage 1-7
1.6 Main Specifications 1-8
1.7 External Dimensions 1-9

2. DESCRIPTION OF PARTS AND FUNCTIONS

2.1 Plotter Nomenclature 2-1
2.2 Control Panel 2-2
2.3 Mounting the Cutter Pen 2-4
2.4 Adjusting the Pen Carriage Height 2-5
2.5 Tilting the Writing Panel 2-6
2.6 Loading the Medium 2-7
2.7 Turning On the Plotter and Initialization 2-8

3. BASIC OPERATION

3.1 Menu Operations 3-1
3.2 Using the Special Functions 3-3
3.3 The Plotter is Turned On But Doesn't Operate 3-5
3.4 Error Messages and Their Causes 3-7
3.4.1 Error messages in GP-GL command mode 3-7
3.4.2 Error messages in HP-GL emulation mode 3-8
3.5 The Cutting Results are Unsatisfactory 3-10

4. INTERFACE FUNCTIONS

4.1 RS232C Serial Interface 4-1
4.2 Centronics-Compatible Parallel Interface (8-Bit Parallel) 4-3

5. DISASSEMBLY AND ADJUSTMENT

5.1 Adjusting the X-Axis Driver 5-1
5.1.1 Removing the X Motor Cover 5-1
5.1.2 Adjusting the X Drive Belt Tension 5-1
5.1.3 Adjusting the Belt Tension of the Front X Slider 5-2
5.1.4 Adjusting the Belt Tension of the Rear X Slider 5-2
5.1.5 Checking the Belt Tension of the Front and Rear X Slider 5-3
5.2 Adjusting the Y-Axis Driver 5-4
5.2.1 Removing the Y Motor Cover 5-4
5.2.2 Removing the Y Motor 5-4
5.2.3 Adjusting the Y Drive Belt Tension 5-6
5.3 Adjusting the Y Slider 5-7
5.3.1 Removing the Y Bar 5-7
5.3.2 Adjusting the Y Slider Belt Tension 5-8
5.4 Adjusting the Roller Pressure of the Front X Slider 5-10
5.5 Adjusting the Roller Pressure of the Rear X Slider 5-11
5.6 Adjusting the Roller Pressure of the Y Slider 5-13
5.7 Adjusting the Position of Sensor Dog Y 5-14
5.8 Mounting the Y Slider on the Y Flexible Printed Circuit Cable 5-15
5.9 Pen Block(One-Pen Specifications) 5-16
5.9.1 Removing the Pen Block Cover 5-16
5.9.2 Removing the Pen Block 5-16
5.9.3 Adjusting the Pen Block 5-17
5.10 Pen Block(Two-Pen Specifications) 5-19
5.10.1 Removing the Pen Block Cover 5-19
5.10.2 Removing the Pen Block 5-19
5.10.3 Adjusting the Pen Block 5-20
5.11 Using the Mechanical Adjustment Jigs 5-22
5.12 Replacing the Y Bar 5-23
5.12.1 Preparations 5-23
5.12.2 Replaceing the Y Bar 5-23
5.12.3 Checking the Sliding of the Y Bar Frame (Manual Check) 5-24
5.13 Adjusting the Perpendicularity Precision 5-25
5.13.1 Checking the Deviation in the Perpendicularity 5-25
5.14 Replacing the Electrostatic Adhesion Plate 5-27
5.14.1 Peeling Off the Electrostatic Adhesion Plate 5-27
5.14.2 Preliminary Preparations for Pasting On New Plate 5-27
5.14.3 Attaching the Electrostatic Adhesion Plate 5-29

6. TROUBLESHOOTING FLOWCHARTS

6.1 Checking for Faulty Rotation of the Blade 6-1
6.2 The Cutting Media Cannot be Satisfactorily Cut 6-2
6.3 Initialization is Abnormal 6-8
6.4 Pen UP/DOWN Operations are Abnormal 6-10
6.5 The X-Axis Backlash is Excessive 6-12
6.6 The Y-Axis Backlash is Excessive 6-13

7. ELECTRICAL ADJUSTMENTS

7.1 Flowchart of the Adjustment Sequence 7-1
7.2 Location of the Boards 7-2
7.2.1 Main Board (PR216001B) 7-2
7.2.2 Main Joint Board (PR223282) 7-3
7.2.3 X Flex. Board (PR223224) 7-3
7.3 Switching the Power Unit's Supply Voltage 7-4
7.4 Power Unit 7-5
7.5 Setting the DIP Switches 7-6
7.6 Clearing the Non-Volatile RAM 7-7
7.7 Default Trimmer Settings 7-8
7.8 Adjusting the Motor Offset 7-9
7.9 Adjusting the Pen Offset 7-11
7.10 Adjusting the Pen Servo 7-12
7.11 Adjusting the Pen Force 7-14
7.12 Adjusting the Main Servo Axes GAIN 7-16
7.13 Adjusting the Pen Interval 7-17
7.14 DIP Switch Factory Settings 7-19
7.15 Factory Preset Settings 7-20
7.16 Using the Test Modes 7-22
7.16.1 Sensor Test Mode 7-22
7.16.2 Keyboard Test Mode 7-23
7.16.3 Setting the Parallel Interface 7-24
7.16.4 Belt Running Test 7-25

8. CONFIGURATION, MAINTENANCE PARTS AND MAINTENANCE TOOLS

8.1 Configuration 8-1
8.2 Maintenance Parts 8-2
8.2.1 Mechanical Maintenance Parts 8-2
8.2.2 Board-Related Maintenance Parts 8-2
8.3 Tools Required for Maintenance Work 8-3

9. DISASSEMBLY DIAGRAMS AND PARTS LISTS

9.1 Mainframe (1-pen type) 9-1
9.2 Mainframe (2-pen type) 9-3
9.3 Stand Section 9-5
9.4 Control Panel Unit 9-7
9.5 Control Unit 9-9
9.6 X Drive Unit 9-11
9.7 Y Drive Section (1-pen type) 9-14
9.8 Y Drive Section (2-pen type) 9-17
9.9 Roll Stocker (Option) 9-20
9.10 Pen Block Conversion 9-20

10. BLOCK DIAGRAMS, CIRCUIT DIAGRAMS, AND PARTS LISTS

10.1 Wiring Connection 10-1
10.2 Key Joint Board (PR223281) 10-3
10.3 Main Joint Board (PR223282A) 10-4
10.4 X Joint Board (PR223203) 10-7
10.5 X Flex Board (PR223224A) 10-8
10.6 X-Y Joint Board (PR223225A) 10-9
10.7 Pen Flex Board (PR223226A) 10-10
10.8 1-Pen Board (PR223107) 10-11
10.9 Pen Board (PR223227A) 10-12
10.10 High Voltage Board (PR31003) 10-13
10.11 Main Board (PR216001) 10-15
10.12 Miscellaneous 10-35

11. VACUUM SUCTION

11.1 Selecting the Vacuum Pump 11-1
11.2 Installation Location 11-2
11.3 Vacuum Pump Wiring 11-3

1. INTRODUCTION

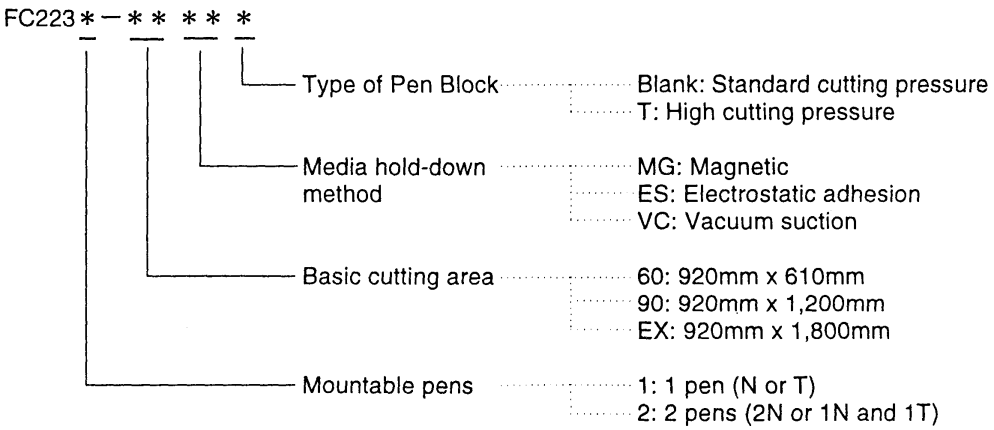
1.1 Model Names and Basic Specifications

The FC2230 series comprises the following models.

Model	No. of pens	Type of pens	Media hold-down method	Cutting area
FC2231-60VC	1	N	Vacuum suction	920mm x 610mm
FC2231-60VCT	1	T		
FC2232-60VC	2	N		
FC2232-60VCT	2	1N and 1T		
FC2231-90MG	1	N	Magnetic	920mm x 1,200mm
FC2231-90ES	1	N	Electrostatic adhesion	
FC2231-90VC	1	N	Vacuum suction	
FC2231-90VCT	1	T		
FC2232-90MG	2	N	Magnetic	
FC2232-90ES	2	N	Electrostatic adhesion	
FC2232-90VC	2	N	Vacuum suction	
FC2232-90VCT	2	1N and 1T		
FC2231-EXMG	1	N	Magnetic	920mm x 1,800mm
FC2231-EXES	1	N	Electrostatic adhesion	
FC2231-EXVC	1	N	Vacuum suction	
FC2231-EXVCT	1	T		
FC2232-EXMG	2	N	Magnetic	920mm x 1,740mm
FC2232-EXES	2	N	Electrostatic adhesion	
FC2232-EXVC	2	N	Vacuum suction	
FC2232-EXVCT	2	1N and 1T		

N: Standard cutting pressure [4.9N (500gf)]
T: High cutting pressure [9.8N (1kgf)]

* Determining specifications from the model name.



1.2 Accessories

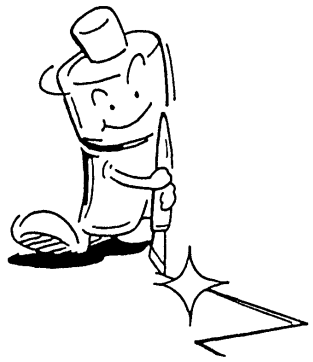
Standard Accessories

Item		Description	Q'ty
Power cable			1
Cutter unit	N type	PPA31-CB09, CB09U, PPA31-CB15B, CB15U-2SP	1 set
	T type	PPA31-CB15B, CB15U-2SP, CB15U-K30-5SP	1 set
Water based fiber-tip pens		KF550-F6	1 pack
Paper		PL525-A2-KP Measurement paper	1 pack
Cutter loupe			1
Soft vinyl cover		For 90/EX models only	1
Sheet holder plates		For magnetic media hold-down (2 large, 2 medium, 4 small)	1 set
Hexagon wrench		For M4 bolts	1
Height adjustment plates		10-mm, 4-mm height	1 of each
Paper alignment seals			1 set
Multilingual control panel labels			1
Durable flexible hose	60VC/VCT	1.5m - 5m (can expand/contract) Connection bore: 38mm	1
	90VC/VCT EXVC/VCT	1.5m - 5m (can expand/contract) Connection bore: 50mm	1
Hose band	60VC/VCT	For 38mm	2
	90VC/VCT EXVC/VCT	For 50mm	2
Vacuum pump installation base		For VC or VCT models only	1
User's Manual		FC2230-UM-151	1
Operating Precautions		FC2230-UM-751	1

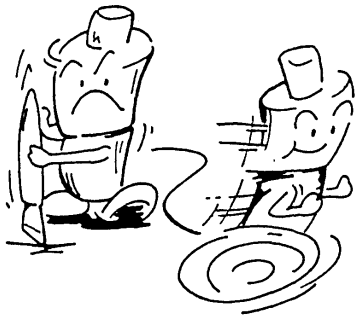
CAUTION:
- Be sure to refer to the Operating Precautions if you wish to use a cable other than the one supplied as an accessory.
- A vacuum pump is not provided with VC models.
- Make sure that the vacuum pump used with a VC model is affixed with either a label showing compliance with the relevant safety standard or with the CE marking.

1.3 Features

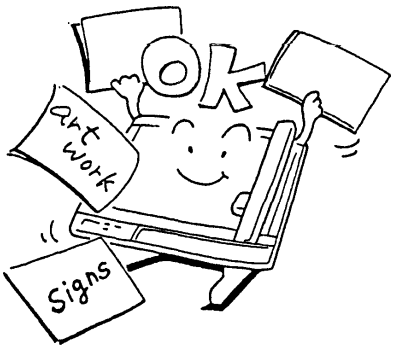
1 The Cutter Offset feature provides a sharply-defined cutting edge



2 Cutting can be performed at a maximum speed of 300 mm per second, and the cutting pressure can be freely selected within a 40-step range. A maximum acceleration of 0.6 G decreases overall cutting time.

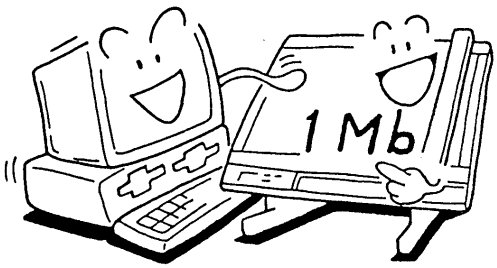


3 This unit can cut not only masking film, but also thick paper, rubber for sandblasting, and other media. Therefore, point-of-purchase (POP) signs, signboards, block copy and other artwork can easily be produced.

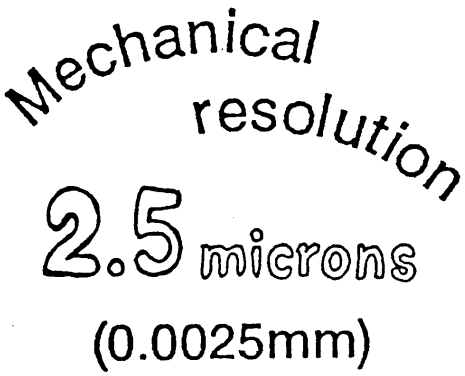


4 Price cards and posters can be made using wide fiber-tip art pens.

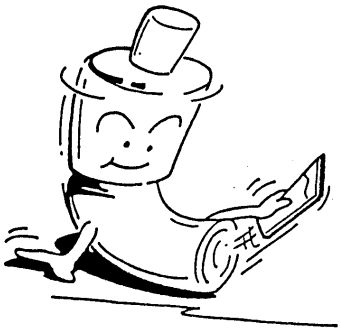
5 The standard 1-Mbyte buffer RAM unit greatly reduces load on the host computer.



6 The FC2230 series uses a digital servo drive system for highly precise cutting results at high speed.



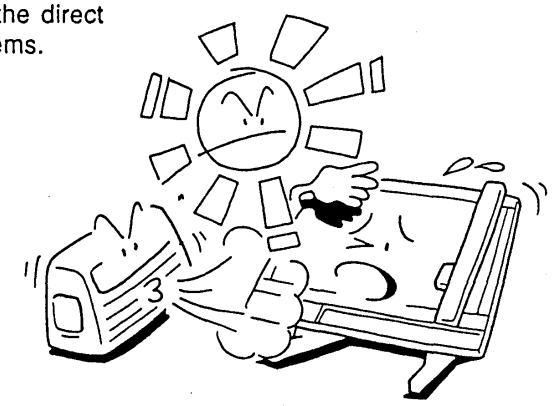
7 Cutter blade replacement is straight-forward.



1.4 Usage Precautions

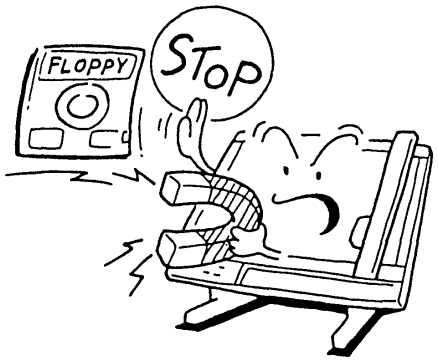
Installation site precautions

- Avoid using or storing this plotter in locations subject to direct sunlight or the direct draft from heating or cooling systems.



- Avoid usage in dusty or humid locations.

- Do not place floppy diskettes or other magnetic objects on the writing panel of models featuring magnetic media hold-down.

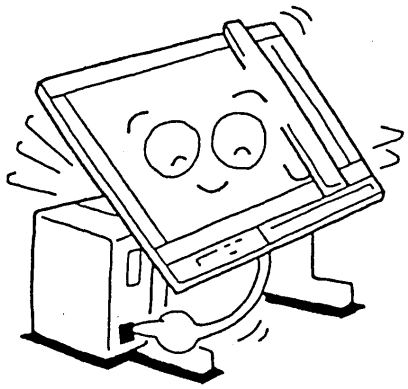


Usage precautions

- Do not lubricate the plotter's mechanisms. Doing so can cause breakdowns and malfunctions.

- When using the cutter pen, be careful not to scratch the writing panel.

- Always turn off the power before adjusting the angle of the writing panel.



1.5 Daily Maintenance and Storage

- During daily maintenance, pay particular attention to the following points.

  1. Do not lubricate the plotter mechanisms.

  2. To clean the plotter's casing, either wipe the soiled areas with a dry cloth or with a cloth that has been dampened with a neutral detergent diluted with water.
     Do not use paint thinner, benzine, alcohol, or similar solvents as they may damage the casing's finish.

  3. If the writing panel surface is soiled, wipe it with a dry cloth. If the surface is extremely dirty, dampen the cloth with a diluted solution of neutral detergent or alcohol.

     - Do not use cleaners or cloths treated with an anti-static agent. Anti-static agents will adversely affect the electrostatic adhesion of the panel.
     - Do not use paint thinner, benzine, or similar solvents on the writing panel. They will damage the surface.
     - Electrostatic adhesion writing panels tend to attract dust from the air. If dust settles on the writing panel, wipe it off.
     - During periods of high humidity, the adhesive force of electrostatic adhesion writing panels may drop slightly.

- When the plotter is not in use, follow the instructions listed below.

  1. Remove the pen from the pen carriage and store it with the pen cap on.

  2. Cover the plotter with the soft cover supplied or a cloth to keep dust off.

  3. Store the plotter in a location which is not subject to either direct sunlight or high humidity.

1.6 Main Specifications

FC2230 Series Specifications

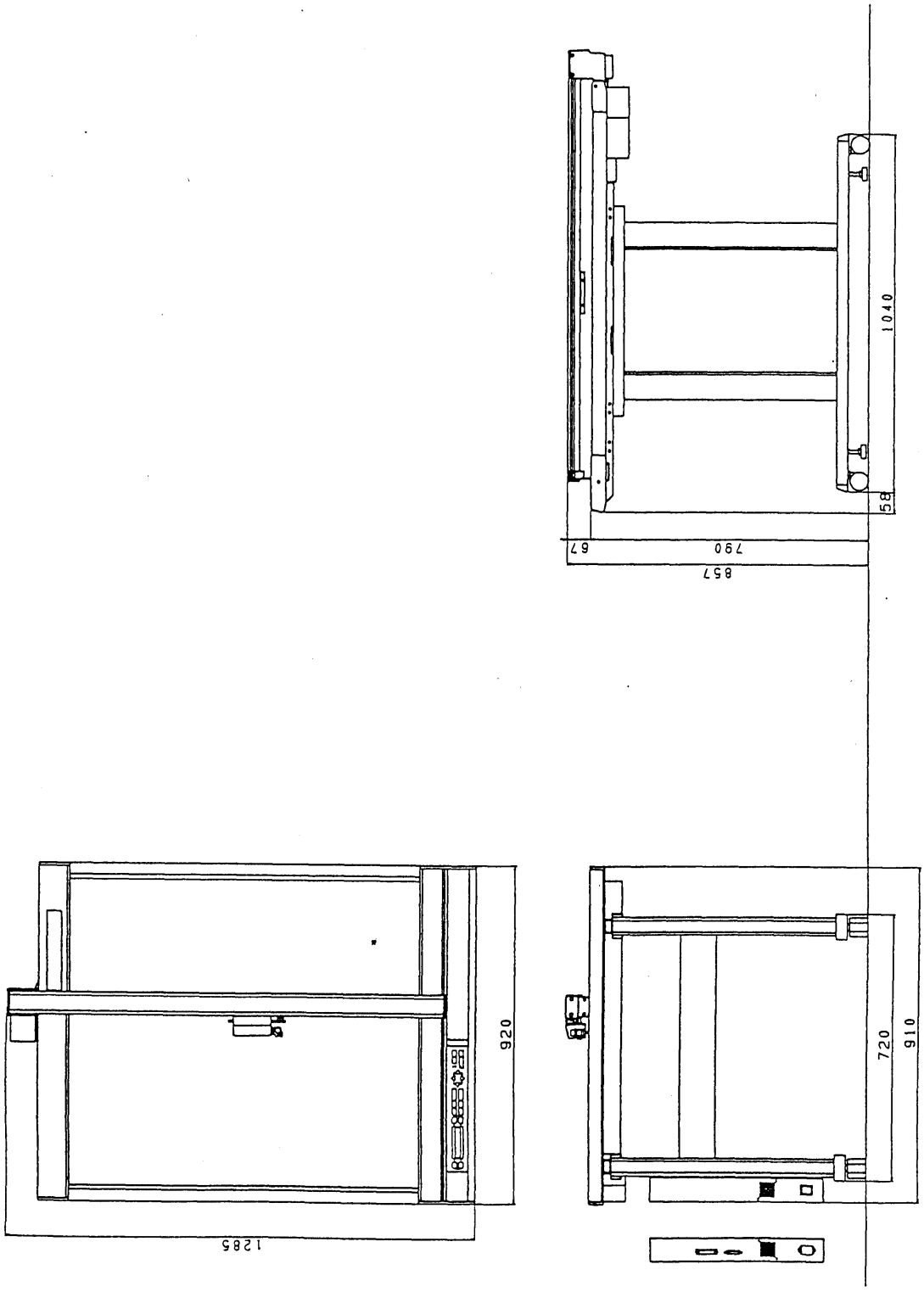
	FC2231-60	FC2232-60	FC2231-90	FC2232-90	FC2231-EX	FC2232-EX
Number of pens/cutters	1	2	1	2	1	2
Effective cutting area	920 x 610mm		920 x 1,200mm		920 x 1,800mm	920 x 1,740mm
External dimensions (H) x (W) x (D)mm	857 × 920 × 1,285 (horizontal)		944 x 1,568 x 1,285 (horizontal) 1,687 x 1,568 x 987 (tilted)*1		944 x 2,068 x 1,285 (horizontal) 1,687 x 2,068 x 987 (tilted)*1	
Weight (including stand)	approx. 58kg		approx. 69kg		approx. 74kg	
Media hold-down method	VC model only: Vacuum suction*2		MG model: Magnetic ES model: Electrostatic adhesion VC model: Vacuum suction*2			
Cutting pressure	N model [4.9N (500gf) max.] : 40-step range (1-40) T model [9.8N (1kgf) max.] : 40-step range (2-80, even numbers only)					
CPU	16-bit					
Configuration	Flatbed					
Drive	Digital servo					
Mechanical resolution	0.0025mm					
Programmable resolution	GP-GL mode: 0.1/0.05/0.025/0.01mm (selected by menu) HP-GL™*3 emulation mode: 0.025mm					
Maximum medium width	1,010mm (Y-axis direction)					
Maximum cutting speed	300mm/s (30-step range)					
Minimum character size	About 10mm square (varies with the character font and cutting media)					
Cutter and pen types	Cutter blades: Supersteel Pens: Fiber-tip pen (water/oil based), ball-point pen (water/oil based), ink pen(*4) (disposable/refillable), ceramic, simplified pencil					
Interfaces	RS-232C serial, Centronics-compatible parallel (automatic interface selection)					
Command sets	GP-GL and HP-GL™(*3) emulation (selected by menu)					
LCD panel	20 characters x 2 lines					
Origin specification	Freely specifiable					
REPLOT function	Provided (COPY mode)					
Test Cut function	Provided (by TEST key)					
Buffer memory	1 Mbyte					
Distance accuracy	Within ±0.1% (plotter mode)					
Repeatability	Within 0.1mm (plotter mode)					
Perpendicularity	Within 0.5mm/900mm (plotter mode)					
Power supply	100-120V ~, 50/60Hz 220-240V ~, 50/60Hz					
Power consumption	120VA max.					
Operating environment	Temperature: +10°C to +35°C Humidity: 35% to 75%RH (non-condensing)					

*1. The FC2231-60, FC2232-60 and all other VC models cannot be used with the writing panel tilted.
*2. A vacuum pump is not provided with VC models.
*3. HP-GL™ is a registered trademark of the Hewlett-Packard Corporation of the United States.
*4. Ink pens cannot be used with FC2231-xxT models.

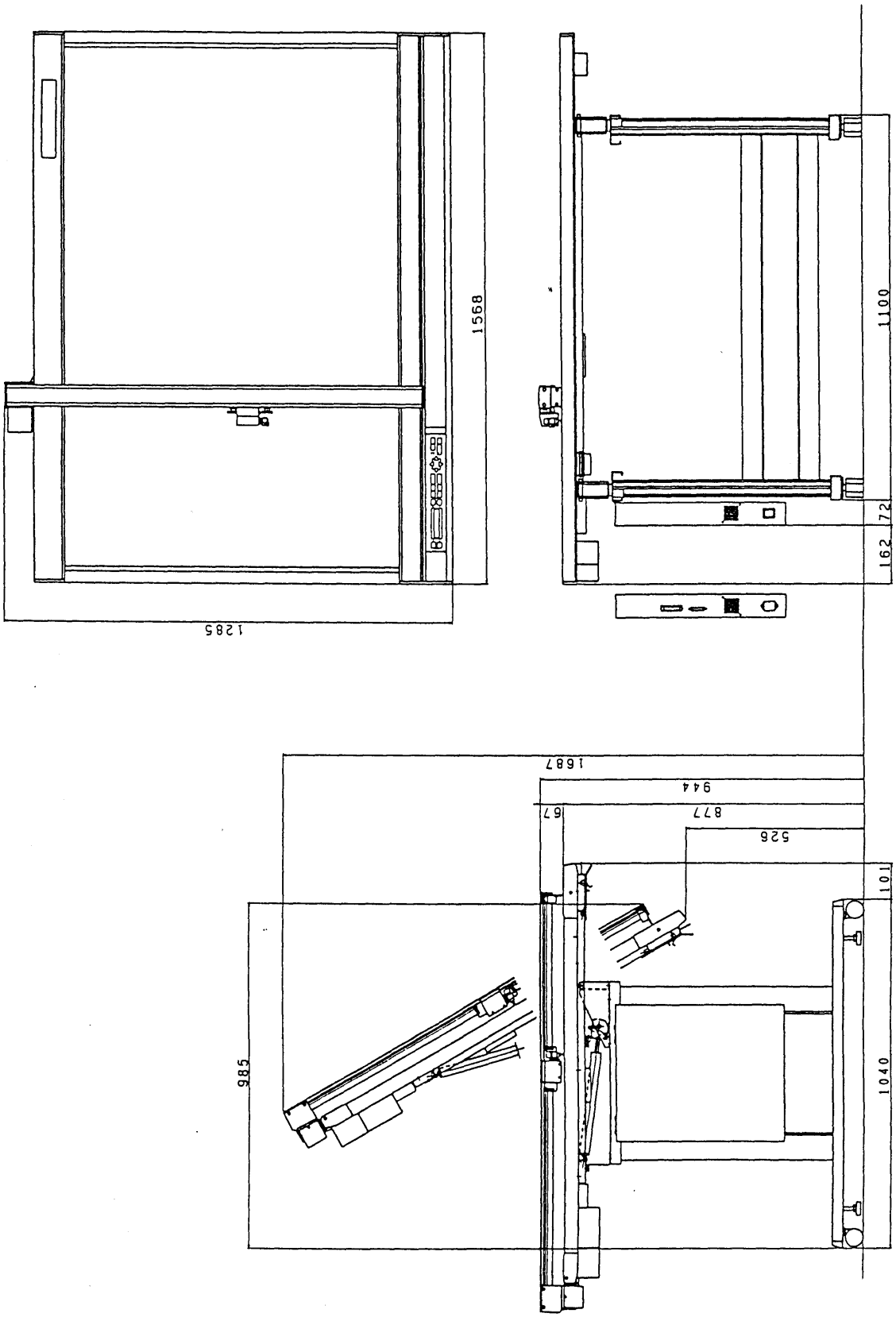
1.7 External Dimensions

Unit: mm

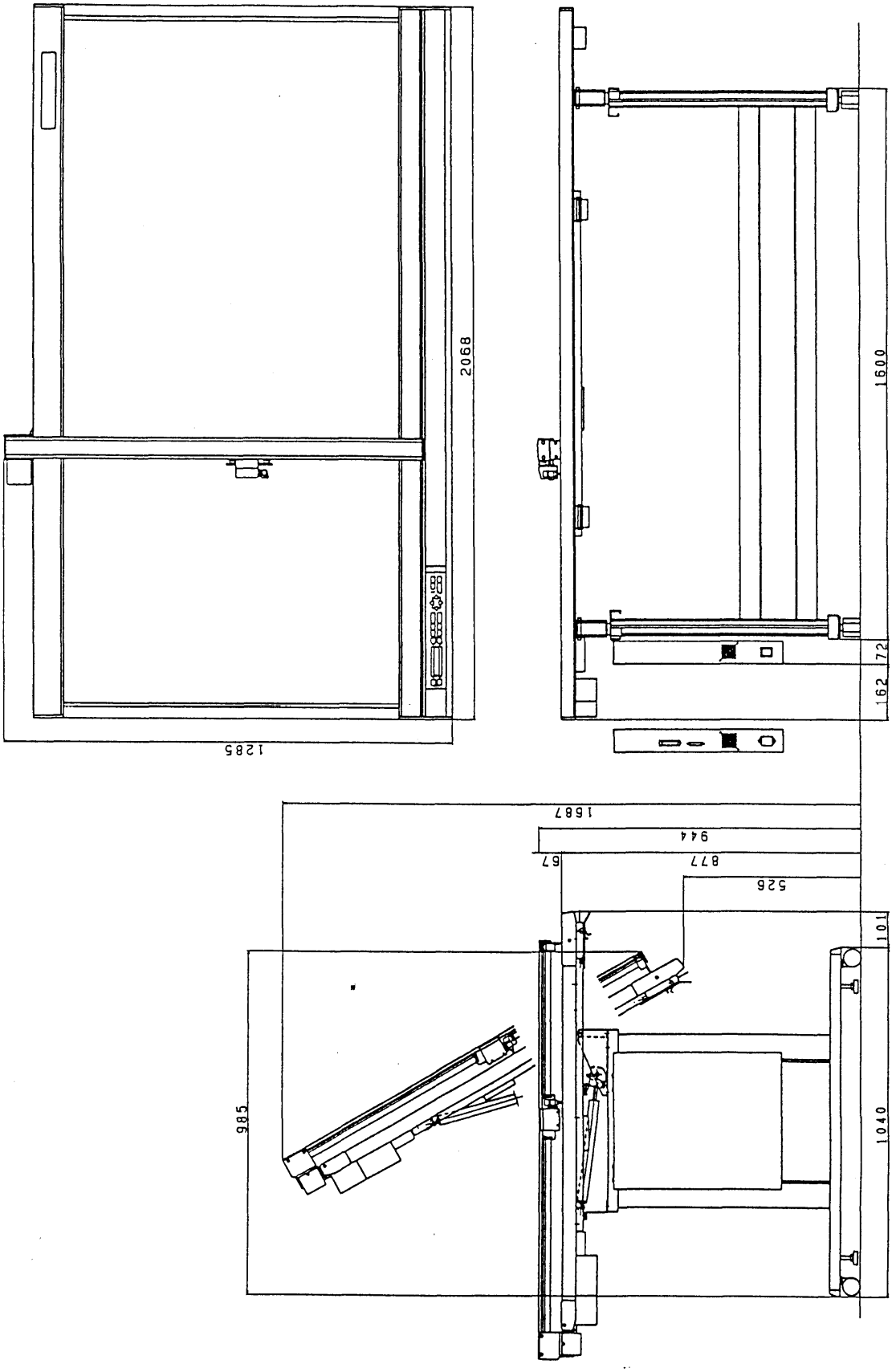
FC2230-60



FC2230-90



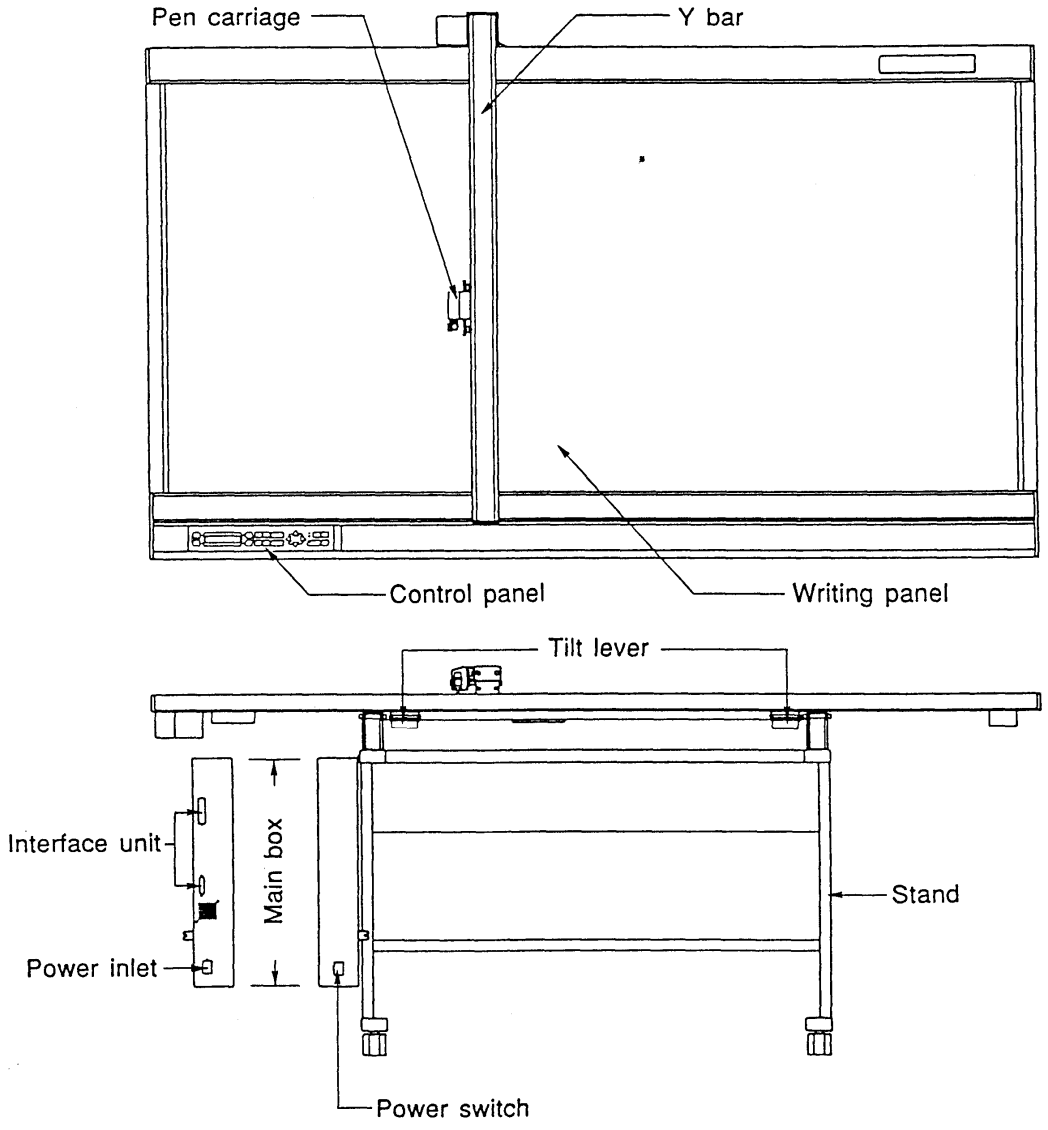
FC2230-EX



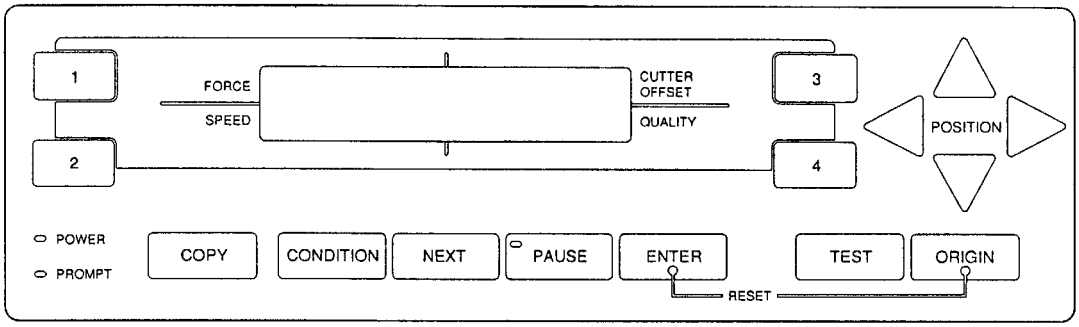
2. DESCRIPTION OF PARTS AND FUNCTIONS

2.1 Plotter Nomenclature

The names of the plotter parts are as follows. (The figure uses an FC2231-EX as an example)



2.2 Control Panel



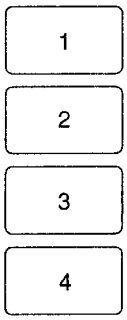
■ Indicator Lamps

POWER

PROMPT

- The POWER lamp remains lit (green) while the plotter is on.
- The PROMPT lamp lights (red) when the plotter receives data that will cause the pen carriage to move outside the effective cutting area or receives the "Prompt Light" command (T) from the computer.

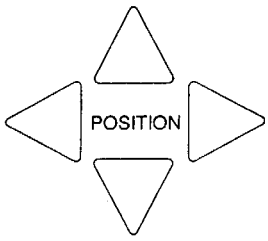
■ SELECT Keys



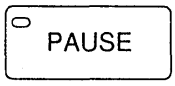
Depending on the menu being displayed, these keys are used to:

- Load a group of cutting conditions retained in the plotter's memory;
- Shift the cursor when setting a numeric value for a function;
- Select the desired submenu.

■ POSITION Keys

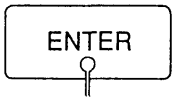


- All four keys are used to move the pen carriage when setting a function that requires the specification of a coordinate position.
- The △ and ▽ keys are used to raise or lower the displayed numeric setting of a function.
- The ◁ and ▷ keys are used to select the pen type when setting a group of cutting conditions.
- Press the △ key and the [ENTER] key concurrently to move the pen carriage to the upper right position and facilitate loading of the cutting medium.

■ 

Press the [PAUSE] key to select PAUSE mode (its green lamp lights) and temporarily suspend a cutting or plotting operation. Press it again to cancel PAUSE mode (the lamp goes off).

Select PAUSE mode to set functions at the control panel or to store data from the computer in the plotter's receive buffer.

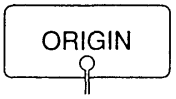
■ 

After setting a function at the display panel, press the [ENTER] key to register your setting.

To reset the plotter, concurrently press the [ENTER] and [ORIGIN] keys.

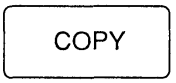
■

Runs a cutting test to check whether the currently selected cutting conditions are compatible with the medium loaded.

■ 

Used to move the origin point.

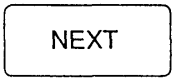
To reset the plotter, concurrently press the [ENTER] and [ORIGIN] keys.

■ 

Used to repeat the cutting operation defined by the data in the plotter's receive buffer.

■

Used to set the four groups of cutting conditions retained in the plotter's internal memory or to select one group as the current cutting conditions.

■ 

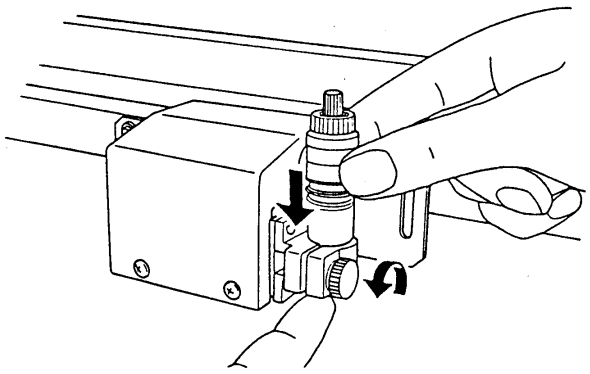
To set a function at the control panel, press the [PAUSE] key to select PAUSE mode and then consecutively press the [NEXT] key until the desired menu appears.

2.3 Mounting the Cutter Pen

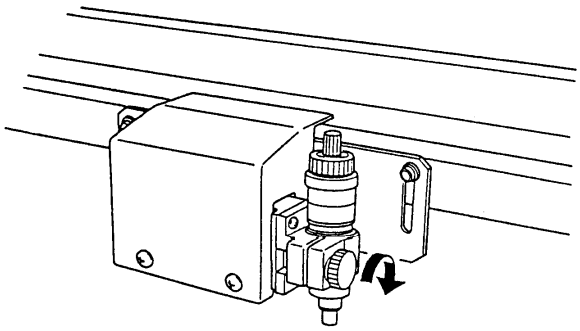
■ 1-pen models

1. Loosen the pen holder screw and mount the pen.

> **NOTE:** Push the pen all the way to the pen stopper section.
> Be careful not to touch the pen tip.



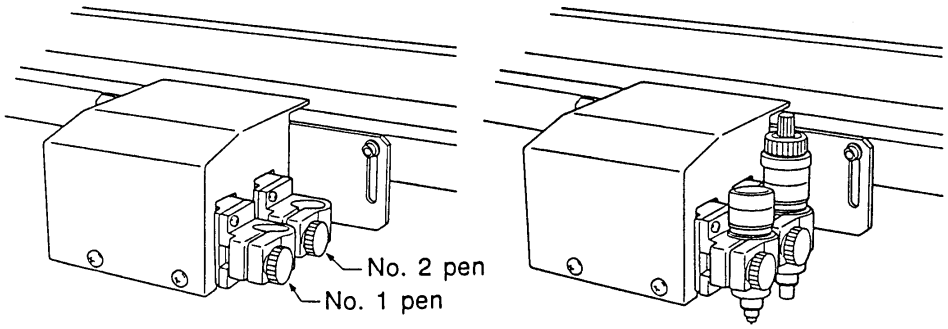
2. After mounting the pen, tighten the screw.



■ 2-pen models

- Mount each of the pens in the same way as that used for 1-pen models.
- When facing the pens, the left pen is designated as No. 1 and the right pen is designated as No. 2.

> **NOTE:** When mounting one cutter pen and one plotter pen, mount the cutter pen as the No. 2 pen.

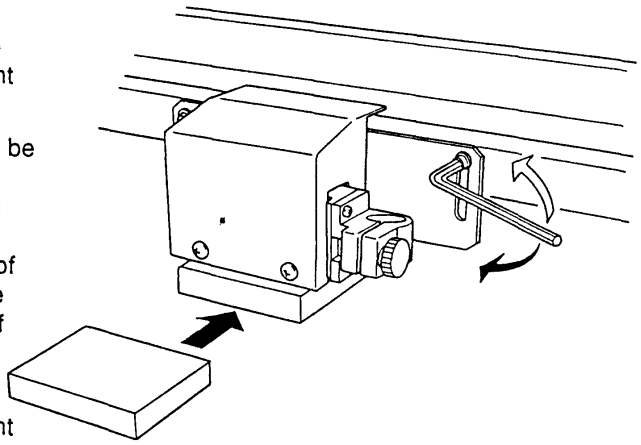


(Pen attaching example)

2.4 Adjusting the Pen Carriage Height

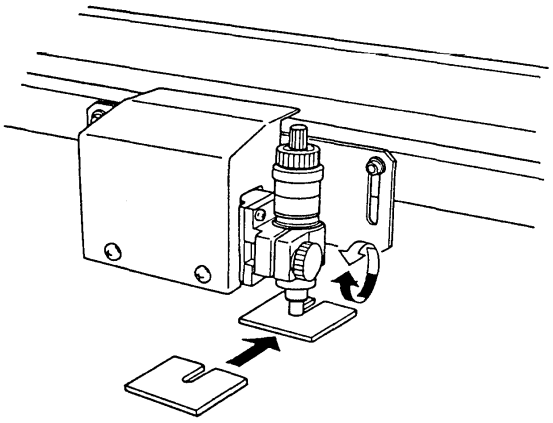
■ 1-pen models

1) Initial adjustment of the pen carriage height



1. Use the hexagon wrench to loosen the height adjustment bolt.
2. When the pen carriage can be moved freely up and down, insert the height adjustment plate (thick) under the pen carriage. Adjust the height of the pen carriage so that the pen carriage rests on top of the plate.
3. Use the hexagon wrench to tighten the height adjustment bolt. Make sure that the pen carriage is parallel to the writing panel.
4. When the adjustment is complete, remove the height adjustment plate (thick) from under the pen carriage.

2) Height adjustment during cutter pen installation



1. Loosen the pen holder section screw and mount the pen.
2. Insert the height adjustment plate (thin) under the pen and adjust the height.
3. After mounting the pen, tighten the screw.
4. When the adjustment is complete, remove the adjustment plate (thin) from under the pen.

■ 2-pen models

The pen height is adjusted in the same manner as that used for 1-pen models.

> **NOTE:** Always make sure that the writing panel is in a horizontal position before making this adjustment. When cutting thick media, place the medium on the writing panel before making this adjustment.

2.5 Tilting the Writing Panel

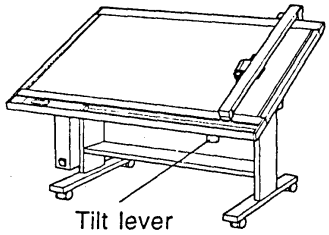
> **NOTE:** The writing panels of VC models cannot be tilted.

This plotter can be used with the writing panel tilted up to 60°.
The tilt can be adjusted in the following way.

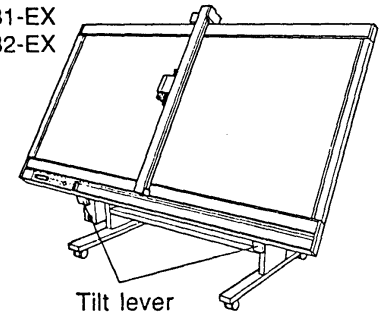
1. Make sure that the power is not ON. If it is ON, turn it OFF.

2. As shown in the illustration below, a tilt lever is located under the writing panel. Grasp the tilt lever and move it to tilt the panel upward or downward. (The EX type has two levers; use them both at the same time when adjusting the angle.)

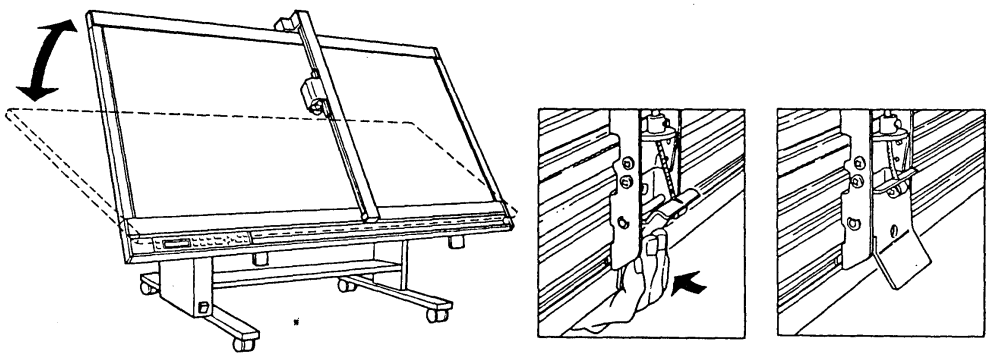
FC2231-90
FC2232-90



FC2231-EX
FC2232-EX



3. When the writing panel is positioned at the desired angle for working, release the tilt lever. The writing panel will be locked in place at that angle.



4. Turn on the power.

> **NOTE:** Even though the cutting pressure values are the same, the actual cutting pressure is different depending on whether the writing panel is tilted or horizontal. Therefore after changing the tilt angle, cutting pressure should be readjusted. When changing from horizontal to the maximum tilt, raise the cutting pressure value by an increment of 2.

2.6 Loading the Medium

NOTES:
1. This plotter is available with an electrostatic writing panel, a magnetic writing panel, or a vacuum suction writing panel. Note the medium is loaded differently depending on the media hold-down method.
2. If air gets in between the writing panel and the medium during loading, force out the air and ensure that the medium is securely attached to the writing panel before cutting.
3. When loading a medium with no backing sheet, spread the optional vinyl backing sheet or something similar on the panel before cutting.
4. When loading a medium that cannot be securely attached using the basic hold-down method, reinforce adhesion by using tape on all four sides. Common spray glue is often used for this purpose. However, since the spray glue remover contains an anti-static agent, do not use it directly on the writing panel of models which feature electrostatic media hold-down.

Media hold-down method

■ Electrostatic adhesion (models feature a black writing panel)

1. Make sure the power is turned ON.
2. Place the medium on the writing panel.
3. Press the [CHART HOLD] key on the control panel.
4. The green [CHART HOLD] key lamp lights to indicate that the medium is being held by electrostatic adhesion.
   * Press the [CHART HOLD] key again to release the electrostatic adhesion. The green lamp will no longer be lit.
   * After the medium has been held for a while by electrostatic adhesion, it may become charged with static electricity and therefore be harder to remove from the writing panel. There is nothing abnormal about this phenomenon.

■ Magnetic (models feature an ivory writing panel)

1. Place the medium on the writing panel.
2. Secure the edges of the medium with the steel holder plates, which are supplied with your plotter as standard accessories.

■ Vacuum suction (models feature a green writing panel)

1. Place the medium on the writing panel.
2. Turn on the vacuum pump's power supply.

CAUTION:
1. Be sure to select a vacuum pump which is affixed with either a label showing compliance with the relevant safety standard or with the CE marking.
2. Before connecting the vacuum pump to a power supply, be sure to read CHAPTER 11 and follow the instructions accordingly.
3. Refer to CHAPTER 11 for pump connection instructions. Be sure to connect the hose and hose band securely.

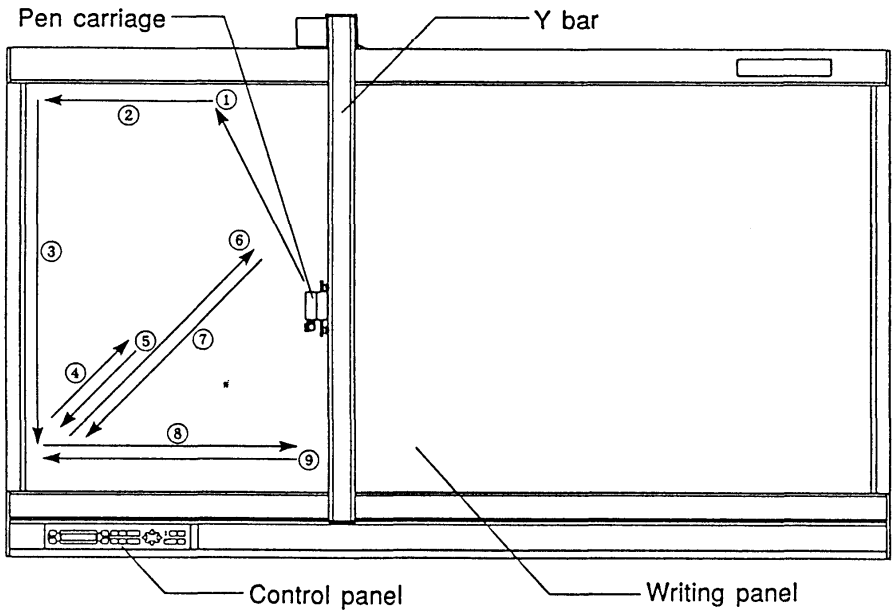
2.7 Turning On the Plotter and Initialization

> **WARNING!** Do not put your hands on the writing panel while turning on the plotter. The moment you turn the power on, the plotter's Y bar and pen carriage will start to move.

Operations:

1. Make sure that the "O" (OFF) side of the power switch is pressed down.
2. Securely plug the connector end of the power cord into the plotter's power inlet.
3. Securely plug the other end of the power cord connector into an electrical outlet of the specified voltage.
4. Press the "I" (ON) side of the power switch.
5. The green power lamp on the control panel will light, and the Y bar and pen carriage will start to move as shown in the figure below. These operations are part of the initialization process.
6. When the initialization process is complete, the plotter is ready to begin plotting or cutting.

   * The figure below shows what the plotter does when the power is turned on. The pen carriage returns to the origin point for plotting, and then moves back and forth twice at a 45° angle from the origin to determine the friction coefficient of the plotter mechanisms.

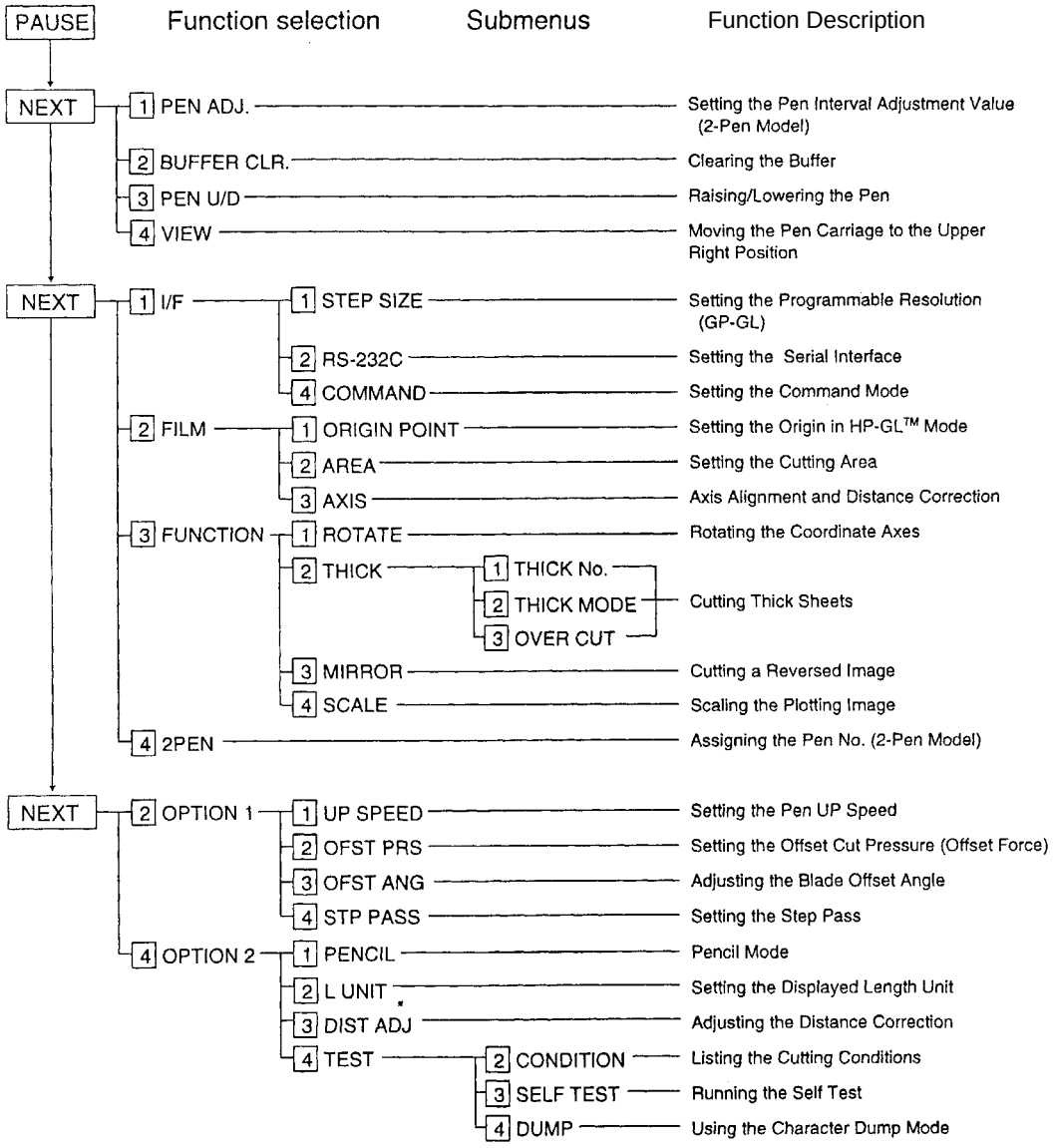


3. BASIC FUNCTION MENU

3.1 Menu Operations

3.1.1 Selecting a Function Menu

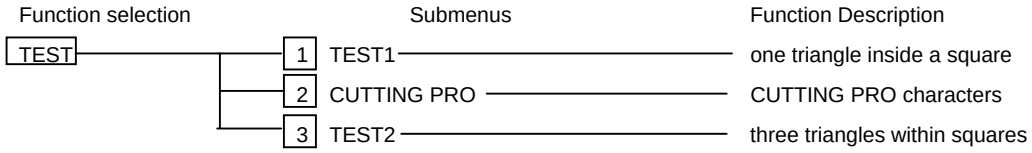
When the plotter is in PAUSE mode, each of the functions listed below in the "Function selection" column can be accessed by pressing the NEXT key until the desired menu appears and then pressing the numeric key indicated by a box.



Using the Character Dump Mode

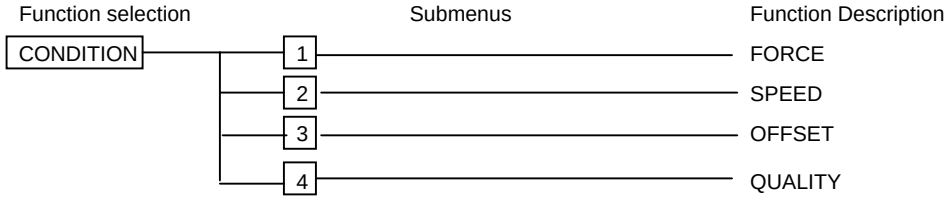
Warning : The pen starts moving as soon as the data is transmitted to the plotter from the computer. To avoid injury to yourself and damage to the plotter, keep your hands, face, and other obstacles out of the vicinity of the pen carriage and Y bar.

3.1.2 Running a Cutting Test



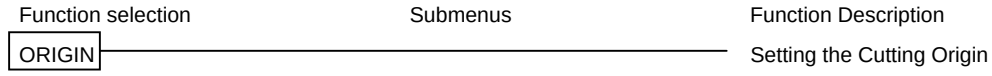
Warning : The pen starts moving as soon as the SELF TEST mode is selected by pressing the 2 key (YES) .
To avoid injury to yourself and damage to the plotter, keep your hands, face, and other obstacles out of the vicinity of the pen carriage and Y bar.

3.1.3 Listing the Cutting Conditions

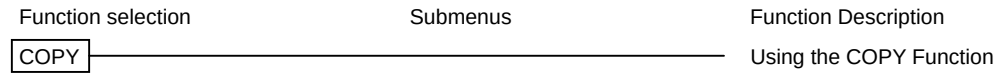


Warning : The pen starts moving as soon as the CONDITION FUNCTION is selected by pressing the 2 key .
To avoid injury to yourself and damage to the plotter, keep your hands, face, and other obstacles out of the vicinity of the pen carriage and Y bar.

3.1.4 Setting the Cutting Origin



3.1.5 Using the COPY Function



Caution : ・While a copy operation is in process, do not send new data to the plotter.
- Data which exceeds 1 Mbyte cannot be stored in the buffer, and therefore cannot be copied.
- Be sure to specify the position of the original cut as close to the origin point as possible. The distance between the original cut and the first copy is the same as the distance between the original cut and the origin.
- If there is an interval of 10 seconds or greater when data is sent, the previous data is cleared.
- Make sure that cutting does not extend past the edges of the film and onto the panel itself.

3.2 Using the Special Functions

Your plotter is also equipped with the special functions described below.

■ ":"/";" Command Control (":",";" COMMAND) [GP-GL command mode]

When the GP-GL command mode is selected, set this function to enable or disable the recognition of ":" and ";" commands sent from the computer. These commands may adversely affect the cutting results if the leading section of data is missing. In such cases, set this function to DISABLED.

■ Pen UP/DOWN for the "W" Command ("W" COMMAND) [GP-GL command mode]

When a command specifying the plotting of an arc is sent from the computer, this function determines whether to raise the pen or leave it in the same status (for example, the pen remains lowered if it was lowered when the command was received) before moving it to the starting position for plotting.

When PEN DOWN is selected, the pen is moved to the starting position in the same status.

When PEN UP is selected, the pen is raised before moving to the starting position.

These settings are effective in cutting mode only.

■ Model No. Response (MODEL EMULATED)

When HP-GL™ command mode is selected, this function selects the plotter's response to an "OI" request sent from the computer.

When 7550 is selected, the plotter's response is 7550.

When 7595 is selected, the plotter's response is 7595.

■ CONDITION PRIORITY

This function determines the priority of programmed cutting conditions and manual settings of cutting conditions at the plotter's control panel.

When MANUAL is selected, commands specifying cutting conditions from the computer are ignored and the cutting conditions can only be set at the control panel. The registered conditions are retained in the plotter's internal memory even while the plotter is turned off.

When PROGRAM is selected, the cutting conditions can be set either at the plotter's control panel or by command input from the computer. When the plotter is turned off, however, the registered cutting conditions are not retained.

■ Initial Blade Control Position (INIT. BLADE CONTROL)

This function specifies the position at which initial blade control is performed

When 2mm BELOW is selected, initial blade control is performed 2 mm below the starting point of cutting.

When OUTSIDE is selected, initial blade control is performed outside of the effective cutting area.

■ Pen UP Movement Control (PEN UP MOVE)

When the plotter receives commands that specify consecutive pen movements in raised status, this function determines whether to move the pen to each coordinate point or to move the pen directly to the final coordinate point.

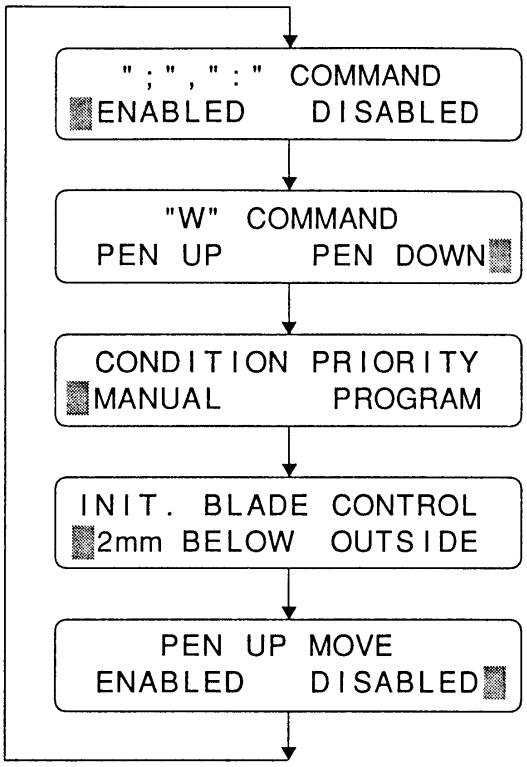
When ENABLED is selected, the pen moves to each coordinate point in sequence.

When DISABLED is selected, the pen moves directly to the final coordinate point.

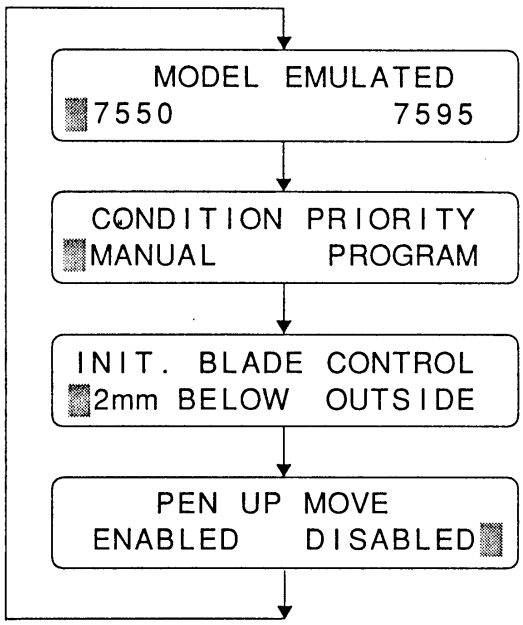
Procedure

While holding down the ▽ key, turn on the plotter.
The special functions are displayed in the sequence shown below.

In GP-GL command mode



In HP-GL™ command mode



To change the setting of the displayed menu, press the [2] or [4] key.
To register the selected setting and proceed to the next menu, press the [ENTER] key.
To proceed to the next menu without changing the setting, press the [NEXT] key.
When you have finished setting all of the special functions, turn off the plotter.

> **Note:** Your settings are registered in the plotter's internal memory and retained even while the plotter is turned off.

3.3 The Plotter is Turned On But Doesn't Operate

Symptom	Cause	Solution
The control panel's POWER lamp does not light. Nothing appears on the display panel.	The plotter is not being supplied with power.	→ Check that the power cord is securely connected to the plotter's AC line inlet and the electrical output.
The POWER lamp lights but the plotter does not operate.	The plotter is defective.	
The control panel's POWER lamp lights but the plotter does not operate. The control panel's PAUSE lamp flickers. Nothing appears on the display panel.	The ROM or RAM is defective.	
The control panel's POWER lamp lights but the plotter does not operate. The message below appears. Sum-Ck ROM RAM ERR!!	The ROM or RAM is defective.	

Error message	Cause	Solution
OVER CURRENT POWER OFF THEN ON POSITION ALARM POWER OFF THEN ON • The beeper sounds • The PROMPT lamp flickers	Excessive load is causing the current to the motor to exceed the rated value • Cutting conditions do not suit the cutting medium • Movement of the pen carriage is being obstructed • The pen carriage was subjected to external pressure during cutting • Film scraps stuck in the plotter's moving parts are impeding operation • Abnormal acceleration rate table	 → Lower the cutting SPEED and/or the cutting FORCE → Turn off the plotter, remove the obstacle, then turn the plotter back on → Turn off the plotter, remove the obstacle, then turn the plotter back on → Turn off the plotter, remove the film scraps, then turn the plotter back on
SPEED ALARM POWER OFF THEN ON • The beeper sounds • The PROMPT lamp flickers	• Immediately after turning on the plotter, excessive force was used to manually move the pen carriage • The internal speed control is faulty	→ Turn the plotter off then back on again → Turn the plotter off then back on again

3.4 Error Messages and Their Causes

3.4.1 Error messages in GP-GL command mode

Error message	Cause	Solution
ERROR 1 COMMAND ERROR	The plotter received an unrecognizable command • Noise was input to the plotter upon execution of the software application • The software configuration regarding the output device has been changed • The plotter's interface conditions have been changed	→ Press the ENTER key → Configure the software to drive your plotter Ensure that the software's interface conditions are correctly set → Ensure that the plotter's interface conditions are set to match those of the software
ERROR 4 PARAMETER OVERFLOW	A command was received containing a numeric parameter that exceeds that command's permissible range • The software configuration regarding the output device has been changed • The plotter's interface conditions have been changed	→ Configure the software to drive your plotter Ensure that the software's interface conditions are correctly set → Ensure that the plotter's interface conditions are set to match those of the software
ERROR 5 I/O ERROR	An error occurred during data transfer • The software configuration regarding the output device has been changed • The plotter's interface conditions have been changed	→ Configure the software to drive your plotter Ensure that the software's interface conditions are correctly set → Ensure that the plotter's interface conditions are set to match those of the software

3.4 Error Messages and Their Causes

3.4.2 Error messages in HP-GL emulation mode

If any of the following command errors occur, they are nearly always caused by one of the reasons below:

(1) The software configuration regarding the output device has been changed; or
(2) The plotter's interface conditions have been changed

When a command error occurs in HP-GL™ emulation mode, therefore, first check the two corresponding points below:

(1) Configure the software to drive your plotter, and ensure that the software's interface conditions are correctly set; and
(2) Ensure that the plotter's interface conditions are set to match those of the software.

Error message	Cause	Solution
ERROR 1 Instruction not recognized	An unrecognizable instruction was executed	Execute a recognizable command
ERROR 2 Wrong number of parameters	A command was executed with the wrong number of parameters	Execute the command with the correct number of parameters
ERROR 3 Out of range parameters	A command containing an unusable parameter was specified	Execute the command with its parameters specified within their permissible ranges
ERROR 5 Unknown character set	An unrecognizable character set was specified	Specify a recognizable character set
ERROR 6 Position overflow	A command was executed with coordinate data that exceeds the effective cutting/plotting area	Execute the command with its coordinate data specified within the effective cutting/plotting area
ERROR 7 Buffer overflow	The data being input exceeded the capacity of the plotter's downloadable character buffer, polygon buffer, etc.	Increase the buffer size

Error message	Cause	Solution
ERROR 10 Invalid I/O output request	During execution of an output command, another output command was executed	Check the flow of your programmed data
ERROR 11 Invalid byte following ESC.	The ESC character was followed by an invalid byte.	Check the ESC commands in your program.
ERROR 12 Invalid byte in I/O Control	A device control command containing an invalid byte was received.	Check the device control commands in your program.
ERROR 13 Out of range I/O parameter	A parameter outside of the permissible numeric range was specified.	Check the program.
ERROR 14 Too many I/O parameters	Too many parameters were received.	Check the number of command parameters.
ERROR 15 Error in I/O transmission	During data transfer, a framing error, parity error, or overrun error occurred.	Check the settings of the interface conditions.
ERROR 16 I/O buffer overflow	The I/O buffer received data at a faster pace than it could process, indicating that handshaking is not successful.	Check the settings of the handshaking mode and other interface conditions.

3.5 The Cutting Results are Unsatisfactory

Problem	Cause	Solution	
• The cut corners are rounded or too pointed	• The CUTTER OFFSET is incompatible with the blade type being used	• Adjust the CUTTER OFFSET value: * If too low, corners become rounded * If too high, corners are too pointed	
• The cut line starts out crooked	• The blade mounted in the holder does not rotate smoothly	• For CB15U holders (red blade adjustment knob), grease the blade and holder	
		• Remove any foreign matter inside the pen holder	
	• The Offset Cut Pressure is too low	• Raise the Offset Cut Pressure setting (the Offset Cut Pressure is separate from the cutting FORCE)	
	• With the 9 mm cutter pen (blue blade adjustment knob), the spring has come loose from the blade	• Replace the blade with a new one that has a spring	
	• With the 15 mm cutter pen (red blade adjustment knob), the blade has fallen out	• Grease the blade and holder (B)	
• The blade skips and does not completely cut lines that should be solid • Solid lines are not cut at a constant depth	• The blade is extended too far	• Adjust the blade length	
	• The cutting SPEED is too high	• Lower the SPEED setting	
• Coarse resolution of curved lines	• The software's resolution setting is too low	• Adjust the software's resolution setting	
	• The blade offset angle is too low	• Raise the blade offset angle	
• The film curls up at the corners • The film curls up when cutting small characters	• The blade is extended too far	• Adjust the blade length	
	• The CUTTER OFFSET is incompatible with the blade type being used	• Adjust the CUTTER OFFSET value: * If too low, corners become rounded * If too high, corners are too pointed	
	• The cutting SPEED is too high	• Lower the SPEED setting	
	• The blade is dull	• Replace the blade	
	• The QUALITY setting is too high	• Lower the QUALITY setting	

Problem	Cause	Solution	
• The blade is cutting into the backing sheet	• The blade is extended too far	• Adjust the blade length	
	• The cutting FORCE is too high	• Lower the FORCE setting	
• The blade falls out of the cutter plunger	• The blade is too small for the holder.	• Use a blade that fits securely in the holder.	
	• Insufficient grease	• For CB15U holders (red blade adjustment knob), grease the cutter blade and holder	
• Film can be cut but is hard to weed afterward • Cut film cannot be picked up using a retack sheet	• The retack sheet is not sticky enough	• Switch to a retack sheet that is more sticky	
	• Film gets entangled during cutting	• Reduce the blade length and/ or lower the cutting FORCE	
	• Cleaning of cut film was postponed too long	• Promptly weed cut film	
• Abnormal noise generated by the cutter pen during cutting • The film is discolored where the blade has passed	• Film is stuck in the tip of the cutter plunger	• Adjust the blade length and cutting FORCE setting	
• The cutting results differ from the specified size	• The programmable resolution (STEP SIZE) has been set differently at the plotter and the software application • Scaling has been specified at the software application	• Set both the plotter and software to the same resolution • Check whether scaling has been specified	
• When the plotter is receiving data, the PROMPT lamp lights (an offscale error occurs) • Some parts of the film cannot be cut	• The programmable resolution (STEP SIZE) has been set differently at the plotter and the software application	• Set both the plotter and software to the same resolution	
	• The computer sent coordinate data that exceeds the specified effective cutting area	• Set the effective cutting area to a larger area	
	• The computer sent coordinate data that exceeds the maximum effective cutting area	• Switch to larger film or change the coordinate data	
• The currently selected cutting conditions are disregarded or cannot be changed	• The Parameter Priority setting is set to program mode • The ENTER key was not pressed after changing the settings	• Change the Parameter Priority setting to manual mode • Make sure you are setting the conditions correctly	

Problem	Cause	Solution	
• Characters or lines are deformed during pen plotting	• The plotter is in Cutting mode	• Set the blade type of the CUTTER OFFSET function to PEN (0)	
• The length of cutting results differ from the program (slight distance error)	• The distance correction requires adjustment	• Adjust the distance correction	
• Cut characters are deformed	• The Step Pass is too high	• Lower the Step Pass setting	
• The starting and end points of cutting do not match	• Coordinate points are incorrectly specified • The Offset Cut Pressure is too low • The film is too flimsy • Blade rotation is not smooth	• Check the coordinate data by plotting it with a pen • Raise the Offset Cut Pressure setting • Switch to a stronger film • For CB15U holder (red blade adjustment knob), grease the cutter blade and holder	

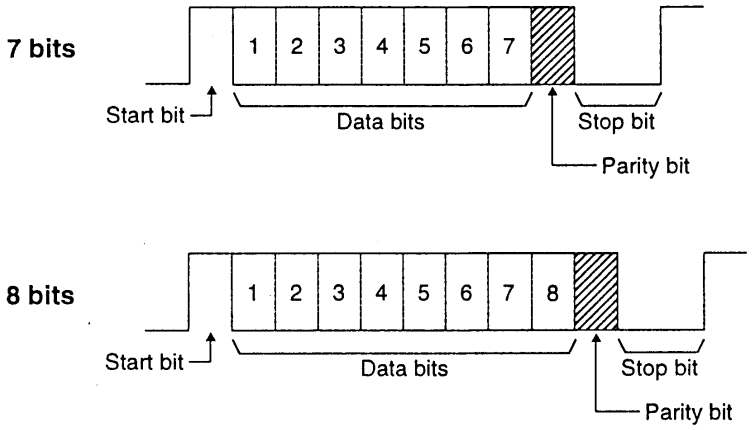
4. Interface Functions
4.1 RS232C Serial Interface

The RS-232C serial interface of your plotter conforms to the RS-232C Standard of the Electronic Industries Association (EIA).

This serial interface performs the serial transfer of digital binary data, control signals, and SYNC signals.

Specifications

Standard	CCITT V.24, EIA RS-232C, JIS X5101
Synchronization	Asynchronous start-stop
Transfer rate	300, 600, 1200, 2400, 4800, 9600 bits/s
Stop bit	2 stop bits
Parity	Even, odd, none
Character length	7 or 8 bits



Electrical Characteristics

	RD,SD (Negative logic)	RS,CS,DR,ER (Positive logic)
Input voltage level	+5V to +12V –5V to –12V	Logical "0" "ON" Logical "1" "OFF"
Output voltage level	* +5V to +8V –5V to –8V	Logical "0" "ON" Logical "1" "OFF"

Compatible Connectors

Plotter end : DB-25S

Cable end : DB-25P
(ISO 2.6mm nuts (M2.6 x 0.45) should be used as the locking nuts.)

Pin Assignment of the Serial Connector

The pin assignment of the RS-232C serial interface connector is described below. In the "Signal direction" column, "←P" indicates signal output from the plotter, and "→P" indicates signal input to the plotter.

Pin no.	Signal symbo	RS-232C	CCITT V. 24	Signal direction	Function
1	FG	AA	101	–	Frame GND for grounding the plotter's chassis
2	SD	BA (TDATA)	103	←P	Transmit data that is output by the plotter
3	RD	BB (RDATA)	104	→P	Receive data that is input to the plotter
4	RS	CA (RTS)	105	←P	The plotter activates the Request to Send signal to confirm whether the computer is ready to receive data
5	CS	(CTS)	106	→P	When the Clear to Send signal is ON, the plotter can send data
6	DR	(DSR)	107		Not used
7	SG	AB (SGND)	102	–	Connected to the plotter's signal ground level
8–19					Not used
20	ER	CD (DTR)	108.2	←P	When the Data Terminal Ready signal is ON, the plotter is ready to receive data
21–25					Not used

4.2 Centronics-Compatible Parallel Interface

This eight-bit Centronics-compatible parallel interface is generally used for interfacing printers.

The input data signals are grouped into the eight bits of the DATA signals (DB0 to DB7), and each group of eight DATA signals is followed by the input of an active-LOW STROBE signal. Upon receipt of the STROBE signal, the plotter activates its BUSY signal, outputs an ACK signal, then reads the input DATA signals to begin a cutting or plotting operation.

When the specified operation is completed, the plotter awaits the input of subsequent DATA signals.

Caution: The interface cable should be no longer than two meters.

Specifications

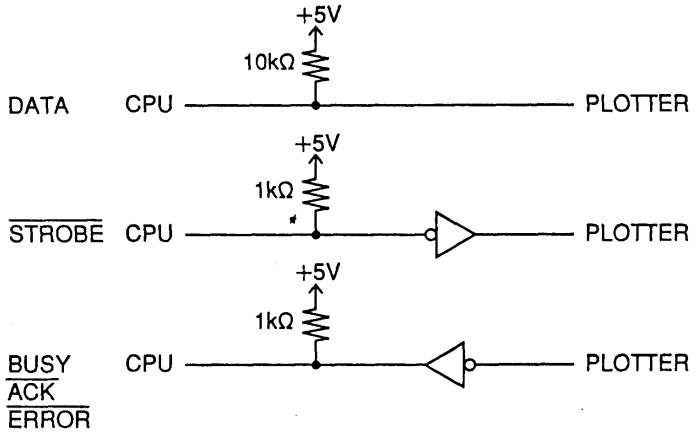
- While the parallel interface is used, data cannot be output from the plotter (that is, READ commands cannot be used with the exception of the "BS" command).
- Synchronization method: Asynchronous transmission by handshaking based on STROBE and BUSY signals.

Electrical characteristics

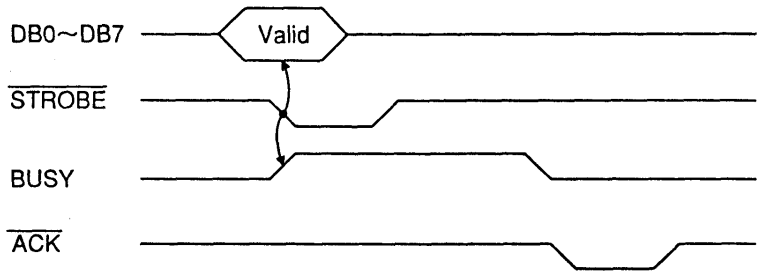
Based on TTL-level compatibility with the logic states below.

Positive logic	"1" + 2.2V or more "0" + 0.8V or less	DATA, BUSY
Negative logic	"1" + 0.8V or less "0" + 2.2V or more	$\overline{\text{ERROR}}$ $\overline{\text{ACK}}$, $\overline{\text{STROBE}}$

Input/Output Circuitry



Input/Output Timing Chart



Compatible Connectors

Plotter end:	FCN685J036-L/Y	(FUJITSU)
Cable end :	57-30360	(DDK)

Pin Assignment of the Parallel Connector

The pin assignment of the Centronics-compatible parallel interface connector is described below.

Pin No.	Signal Name	Pin No.	Signal Name
1	$\overline{\text{STROBE}}$	19	GND
2	DB 0	20	GND
3	DB 1	21	GND
4	DB 2	22	GND
5	DB 3	23	GND
6	DB 4	24	GND
7	DB 5	25	GND
8	DB 6	26	GND
9	DB 7	27	GND
10	$\overline{\text{ACK}}$	28	GND
11	BUSY	29	GND
12	GND	30	GND
13	SLCT	31	Not used
14	Not used	32	$\overline{\text{ERROR}}$
15	Not used	33	GND
16	GND	34	Not used
17	Not used	35	GND
18	+5V	36	GND

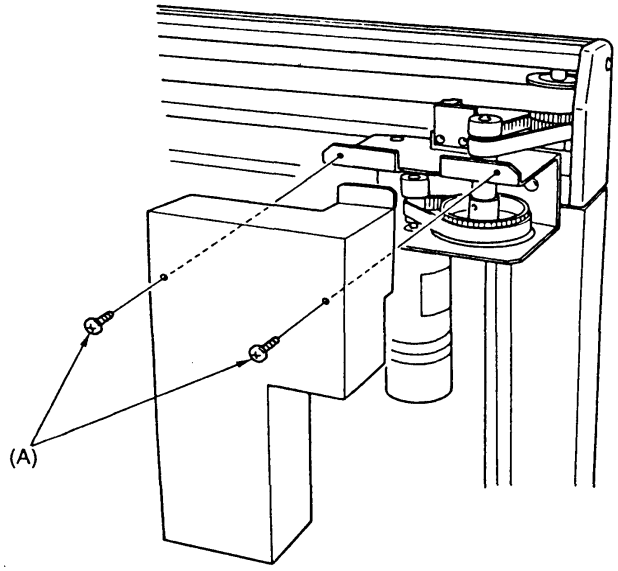
5. DISASSEMBLY AND ADJUSTMENT

NOTE: All the disassembly and adjustment procedures in this chapter are the same as those for the FC2201-90/90EX and FC2202-90/90EX.

5.1 Adjusting the X-Axis Driver

5.1.1 Removing the X Motor Cover

Remove the two 3 mm bind screws indicated by the (A) arrows, then remove the motor cover.

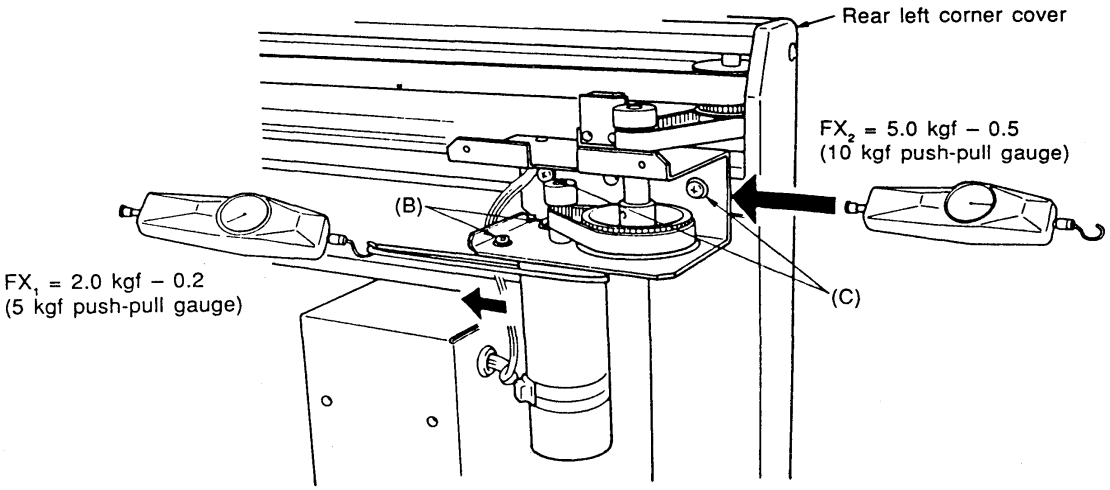


5.1.2 Adjusting the X Drive Belt Tension

(1) Remove the rear left corner cover.

(2) After loosening the two 3 mm bind screws indicated by the (B) arrows, attach a string around the X motor and pull the X motor with a 5 kgf push-pull gauge to the point where FX_1 equals 2.0 kgf – 0.2, then tighten the screws.

(3) After loosening the two 4 mm bind screws indicated by the (C) arrows, push the X motor bracket with a 10 kgf push-pull gauge to the point where FX_2 equals 5.0 kgf – 0.5, then tighten the two screws.



5.1.3 Adjusting the Belt Tension of the New Type Front X Slider

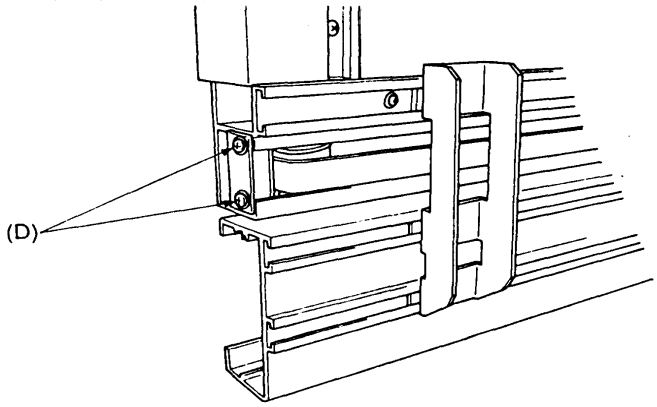
(1) Remove the front right corner cover.

(2) Adjust the two 3 mm bind screws indicated by the (D) arrows so that the belt is balanced right and left.

* Turn the screws to the right to tighten the belt.
* Turn the screws to the left to loosen the belt.

(3) Check the belt tension. (See subsection **5.1.5**, "Checking the Belt Tension of the Front and Rear X Sliders".)

(4) Perform the radiating lines test to check that the belt at the pulley section is balanced right and left.
If not, repeat steps (2) to (4) above so that the belt is balanced.



5.1.4 Adjusting the Belt Tension of the New Type Rear X Slider

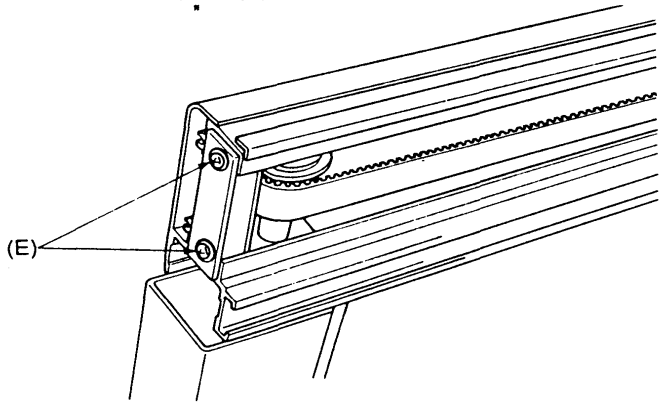
(1) Remove the rear right corner cover.

(2) Adjust the two 3 mm bind screws indicated by the (E) arrows so that the belt is balanced right and left.

* Turn the screws to the right to tighten the belt.
* Turn the screws to the left to loosen the belt.

(3) Check the belt tension. (See subsection **5.1.5**, "Checking the Belt Tension of the Front and Rear X Sliders".)

(4) Perform the radiating lines test to check that the belt at the pulley section is balanced right and left.
If not, repeat steps (2) to (4) above so that the belt is balanced.



5.1.5 Checking the Belt Tension of the Front and Rear X Sliders

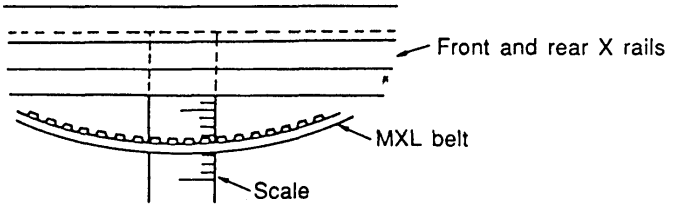
(A) Checking the Belt Tension

(1) Move the Y bar against the mechanical stopper on the left side.

(2) Set the writing panel in the horizontal position.

(3) Measure the slack in the MXL belt at the center of the front and rear rails below the pertinent position given below:

For FC2231-60 / -90, FC2232-60 / -90 : Between the 2 countersunk head screws
For FC2231-EX / FC2232-EX : The central countersunk head screw

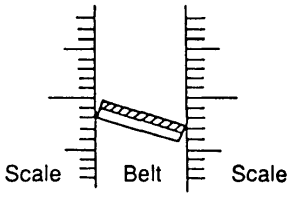


(4) Measure the distance between the bottom surface of the X rail and the belt's upper surface.

(5) Measure the slack at the front and back of the belt, then calculate the average of the two measured values (because the belt may be twisted as shown in the figure below).

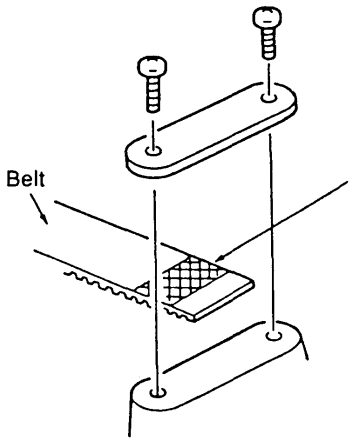
(B) Judging the Belt Tension

FC2231-90 / FC2232-90 : 21 ± 0.5 mm (rear)
30 ± 0.5 mm (front)
FC2231-EX / FC2232-EX : 21.5 ± 0.5 mm (rear)
30.5 mm ± 0.5 mm (front)



FC2231-60 / FC2232-60
: 20.5±0.5mm (rear)
30.0±0.5mm (front)

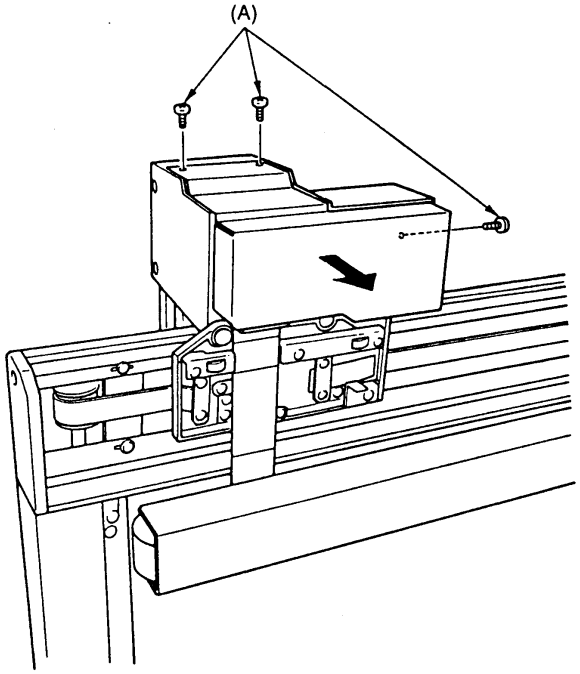
NOTES: 1. If the belt tension has been adjusted, confirm that the Y bar is perpendicular.
2. If the belt has been completely removed from the holder, secure it with adhesive to prevent looseness.


Belt
Adhesive
Secure the belt using bond-type adhesive.
Apply the adhesive sparingly to avoid
contact with the M3 screws on both sides.

5.2 Adjusting the Y-Axis Driver

5.2.1 Removing the Y Motor Cover

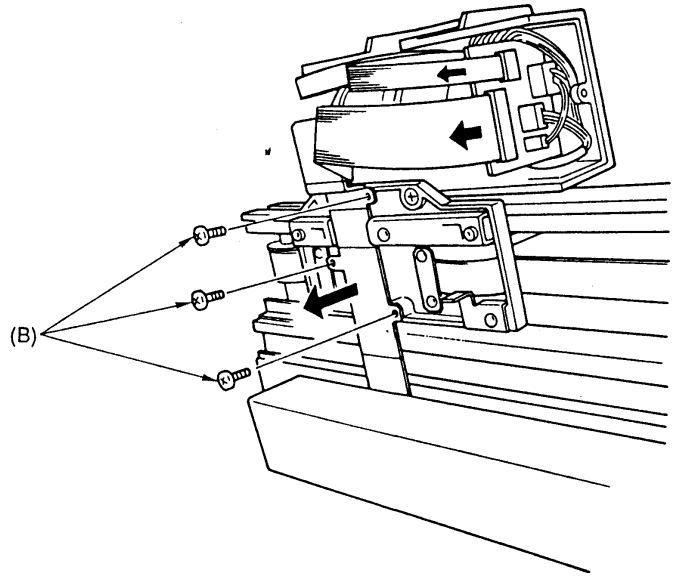
Remove the three 3 mm bind screws indicated by the (A) arrows, then remove the Y motor cover in the direction indicated by the arrow.



5.2.2 Removing the Y Motor

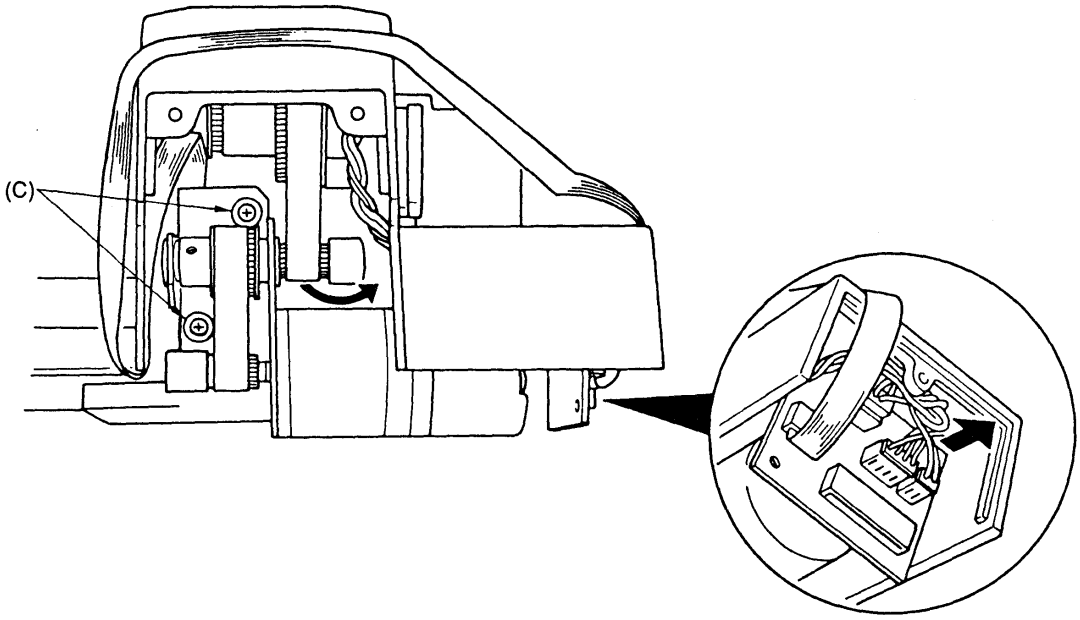
(1) Remove the three 3 mm bind screws indicated by the (B) arrows, then remove the X FPC (Flexible Printed Circuit) cable holder.

(2) Pull out J51 (X FPC cable) and J52 (Y FPC cable) from their connectors on the PR223225 relay board in the direction indicated by the arrows.



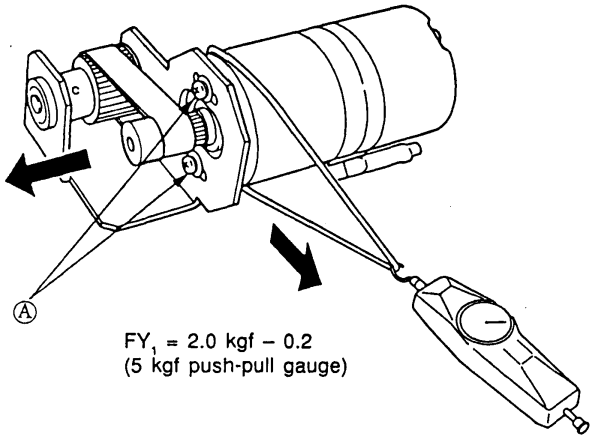
(3) As shown in the figure on the right, pull out the P501 (Y motor) and P502 (Y encoder) cables from their connectors on the PR223225 relay board in the direction indicated by the arrow.

(4) As shown in the figure on the left, remove the two 4 mm bind screws indicated by the (C) arrows, then slip the synchro belt indicated by the arrow off of the motor pinion gear and remove the entire motor bracket.

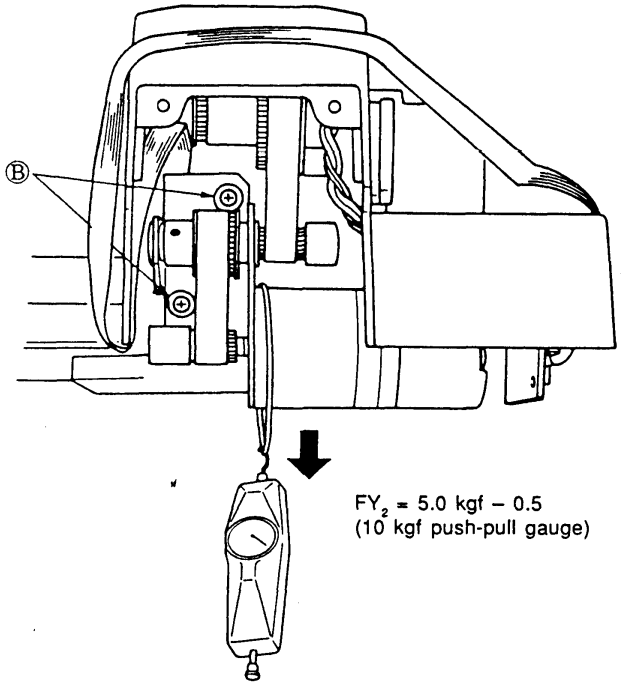


5.2.3 Adjusting the Y Drive Belt Tension

(1) After loosening the two 3 mm bind screws indicated by the (A) arrows in the figure below, attach a string around the Y motor and pull the Y motor with a 5 kgf push-pull gauge to the point where FY_1 equals 2.0 kgf – 0.2, then tighten the two screws.



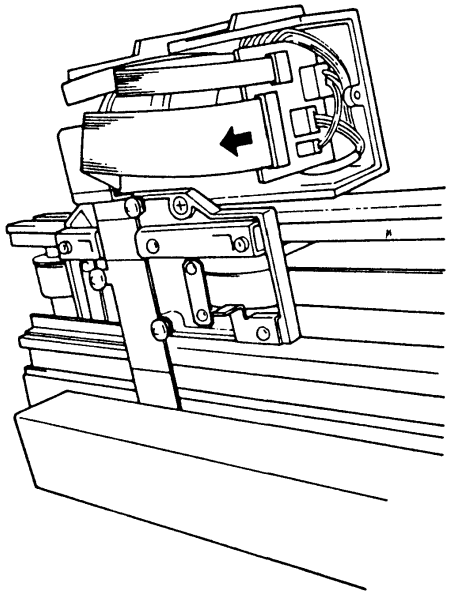
(2) After loosening the two 4 mm bind screws indicated by the (B) arrows in the figure below, attach a string around the Y motor and pull the Y motor assembly with a 10 kgf push-pull gauge to the point where FY_2 equals 5.0 kgf – 0.5, then tighten the two screws.



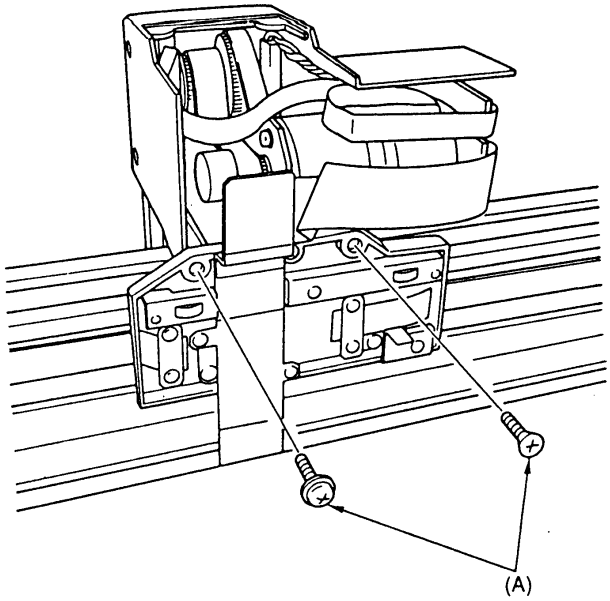
5.3 Adjusting the Y Slider

5.3.1 Removing the Y Bar

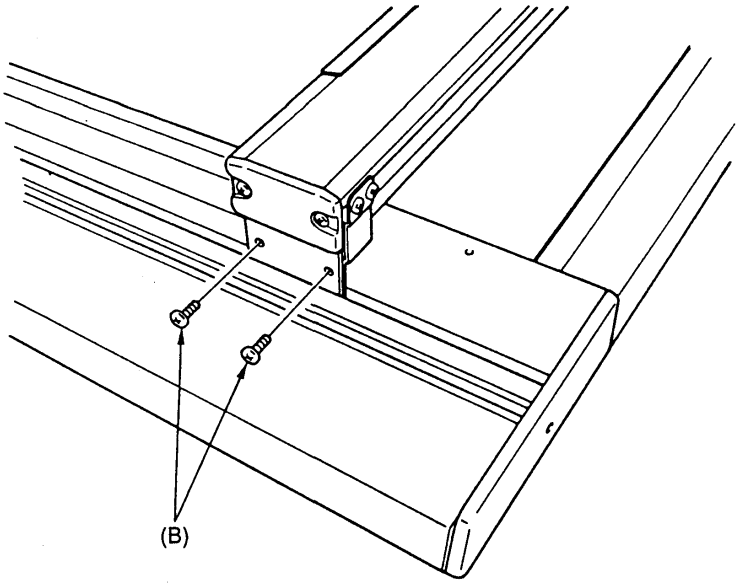
(1) Remove the motor cover, then pull out the X FPC cable connector in the direction indicated by the arrow. (The pen block should be removed first.)



(2) Remove the 5 mm bind screw and the countersunk head screw indicated by the (A) arrows.

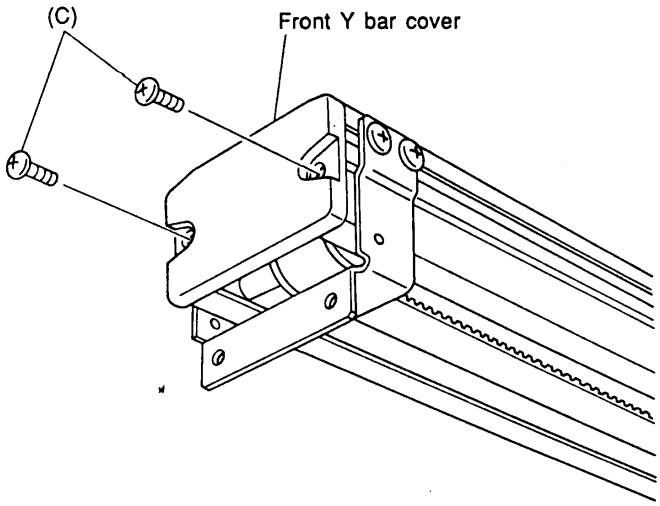


(3) After removing the two 4 mm bind screws indicated by the (B) arrows at the front surface, use both hands to lift the Y bar up and off.



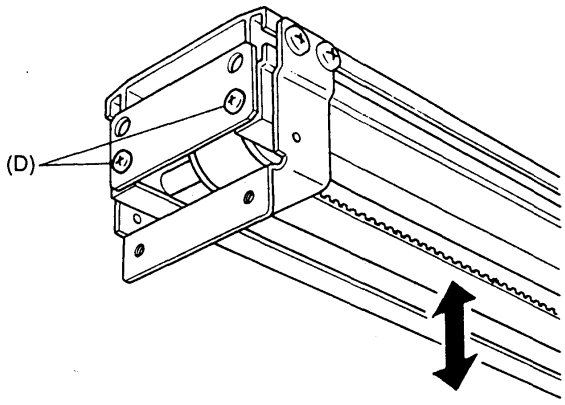
5.3.2 Adjusting the Y Slider Belt Tension

(1) Remove the two 4 mm bind screws indicated by the (C) arrows, then remove the front Y bar cover.



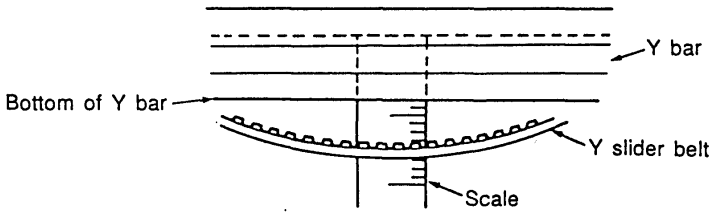
(2) Adjust the two 3 mm bind screws (D) so that the belt is balanced right and left.

- Turn the screws to the right to tighten the belt.
- Turn the screws to the left to loosen the belt.



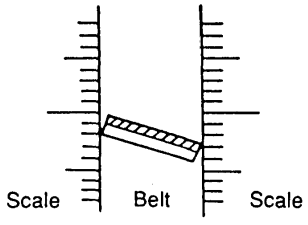
(3) Check the Y slider belt tension.

- Slide the pen block to the motor side.
- Measure the slack of the belt near the center of the Y bar.

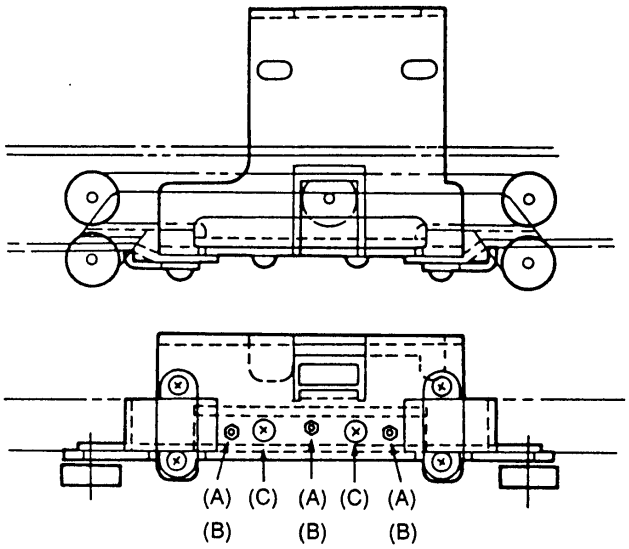


- Measure the distance between the bottom surface of the Y bar and the belt's upper surface.
- Measure the slack at the right and left of the belt, then calculate the average of the two measured values (because the belt may be twisted as shown in the figure below).

$21.2^{0}_{-0.5}$mm



5.4 Adjusting the Roller Pressure of the Front X Slider



(1) Insert the front X slider assembly from the right side of the front X rail (the tension adjustment holder side).

(2) Loosen the two bind screws indicated by (C) by turning them each fully twice, tighten the three M3x6 setscrews in the three taps indicated by (B), then lock the setscrews using M3 nuts at the position where the rollers contact the front X rail.

(3) Using the three screws indicated by (A), apply pressure to the rollers by adjusting the rollers so that they are parallel to the sliding surface.

(4) Tighten the two bind screws indicated by (C), and then secure them with adhesive after confirming that the rollers remain in contact with the sliding surface throughout their entire stroke, the sound made by the rollers turning is constantly the same, and the rollers slide smoothly.

NOTES: 1. Visually confirm that each roller is in contact with the sliding surface.
2. After adjusting the roller pressure, the sliding load shall be 35 gf ± 5.

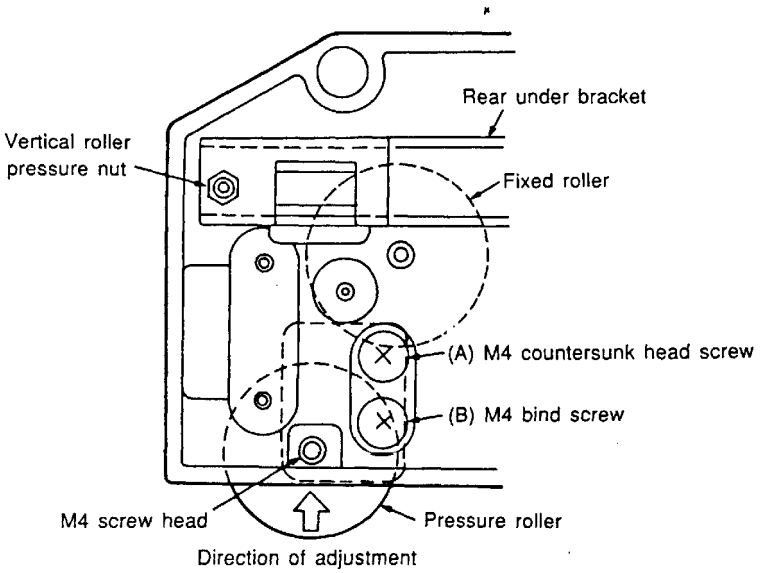
5.5 Adjusting the Roller Pressure of the Rear X Slider

(1) Using gauze or soft cloth moistened with ethyl alcohol, clean the sliding surface of the rear X rail. At this time, confirm the absence of scratches or dents in the sliding surface.

(2) Loosen the screw of the pressure (adjustable) roller of the rear X slider. When inserting the rear X rail from the belt tension adjustment holder side, take care that the plastic roller is not scratched by the edge of the rear X rail.

(3) Adjusting the horizontal roller pressure

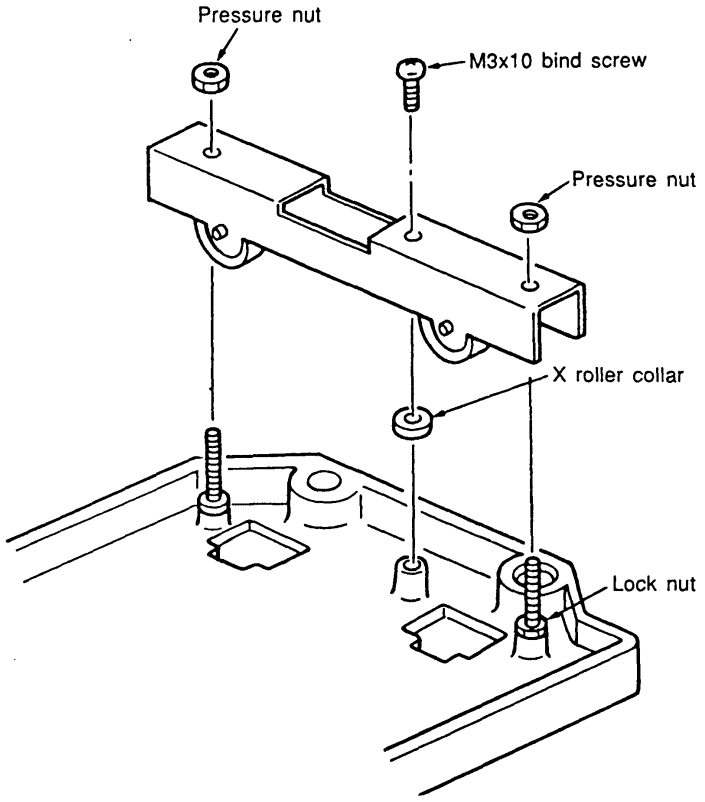
- After adjusting the screws indicated by (A) and (B), be sure to lock them in place with adhesive.



- After tightening screw (A), loosen it by a quarter turn. Use a blade screwdriver to press the screw head (C) in the direction indicated by the arrow, then tighten screws (A) and (B) at the position where the pressure roller contacts the sliding surface of the rear X rail. (Repeat this same procedure for the right roller.) Confirm that the rollers remain in contact with the sliding surface throughout their entire stroke, the sound made by the rollers turning is constantly the same, and the rollers slide smoothly.

(4) Adjusting the vertical roller pressure

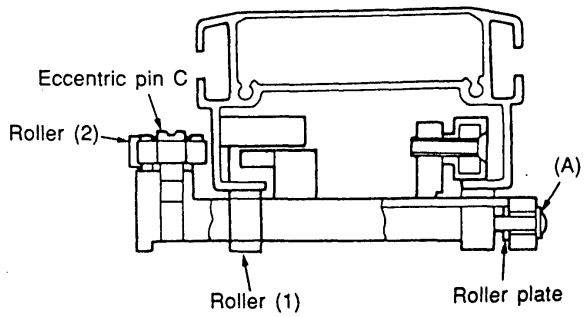
- Use the vertical roller pressure nuts (also shown in the preceding figure) to move the rollers into contact with the sliding surface of the rear X rail, then secure the nuts with adhesive.

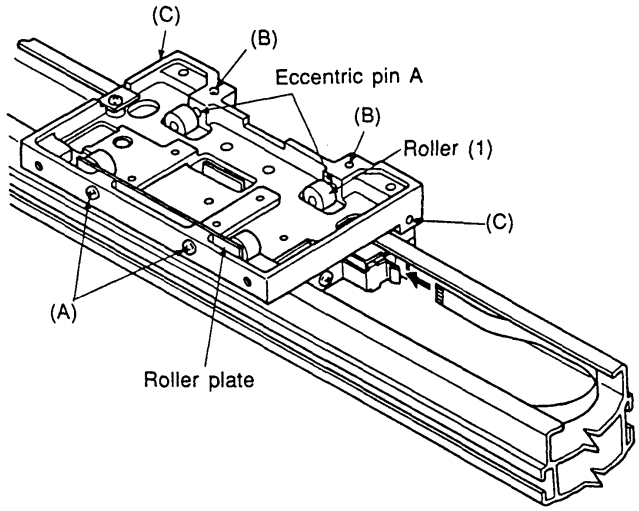


NOTES: 1. Confirm the horizontal roller pressure by visually checking that both the fixed and adjustable rollers are in contact with the sliding surface.

2. After adjusting the roller pressure, the sliding load shall be 35 gf ± 5.

5.6 Adjusting the Roller Pressure of the Y Slider





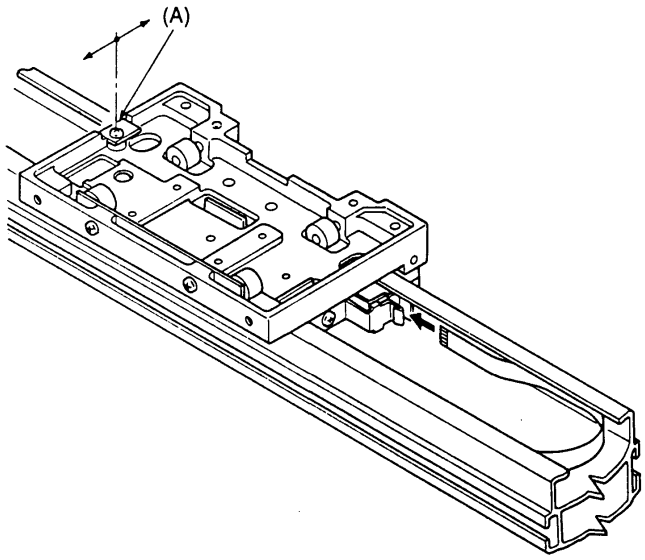
(1) Mounting the Y slider onto the Y bar

- Loosen the two screws (A), lower the roller plate and temporarily secure it in that position.
- Loosen the setscrews (B) at the two eccentric pins A, then temporarily secure the roller (1) in a lowered position.
- Loosen the setscrews (C) at the two eccentric pins C, then move roller (2) outside of the Y slider and temporarily secure it in that position.

(2) Adjusting the Y slider's roller pressure

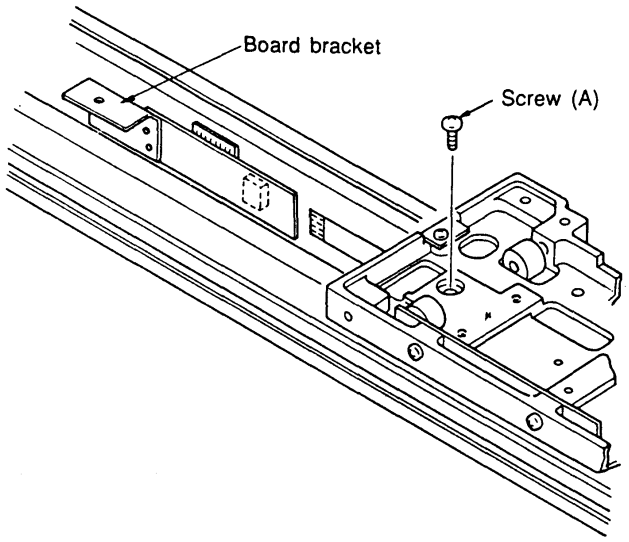
- With the Y slider oriented as shown in the figure above, insert it onto the Y bar, then move each roller back into contact with the sliding surface by performing the steps in (1) above in reverse sequence.
- Visually confirm that each roller rotates while maintaining contact with the sliding surface. Check that there is no play in the front, back, or side directions.
- Make sure there are no discrepancies in the "grating" load of the rollers.
- The sliding load shall be 30 gf ± 5.
- After the adjustment is completed, apply adhesive to the four setscrews.

5.7 Adjusting the Position of Sensor Dog Y



Align the sensor dog Y (A) with the center of the Y sensor's slit, then apply adhesive to secure the sensor dog Y in that position.

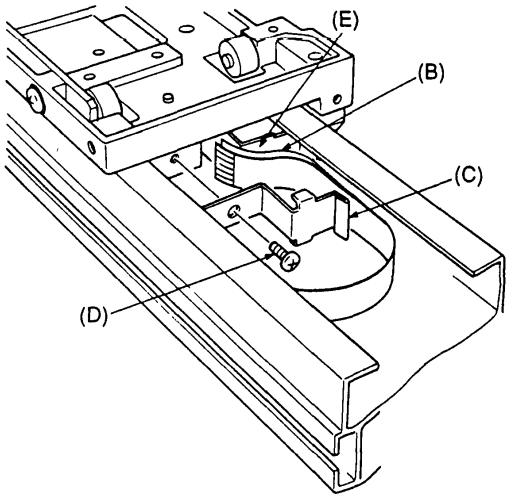
5.8 Mounting the Y Slider on the Y Flexible Printed Circuit Cable



(1) Remove the screw (A) from the board bracket and pull it out as shown in the figure above.

(2) Pass the Y flexible printed circuit (FPC) cable through the FPC guide (B) shown in the figure below, then insert the FPC cable into the connector.

(3) Secure the board bracket to the Y slider using the screw which was removed in Step (1) above.



(4) Attach double-sided tape to the FPC guard (E), and then securely attach the FPC guide (B) to the other side of the tape.

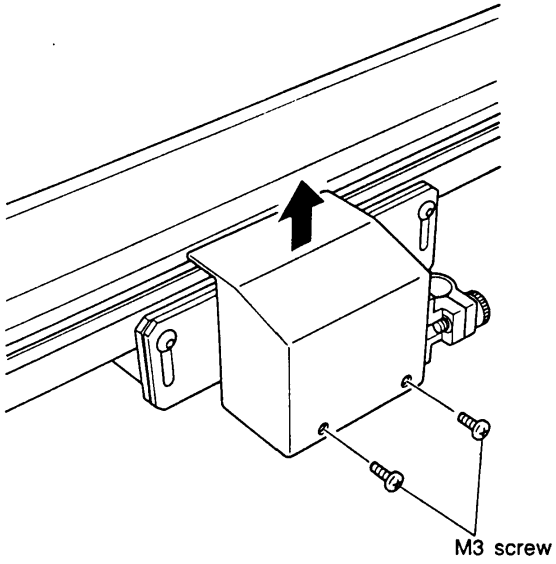
(5) Pass the Y FPC cable between FPC holder (C) and FPC guide (B), and then secure the cable with a push-fit M3x6 screw (D).

(6) Apply adhesive to screw (D).

5.9 Pen Block (One-Pen Specifications)

5.9.1 Removing the Pen Block Cover

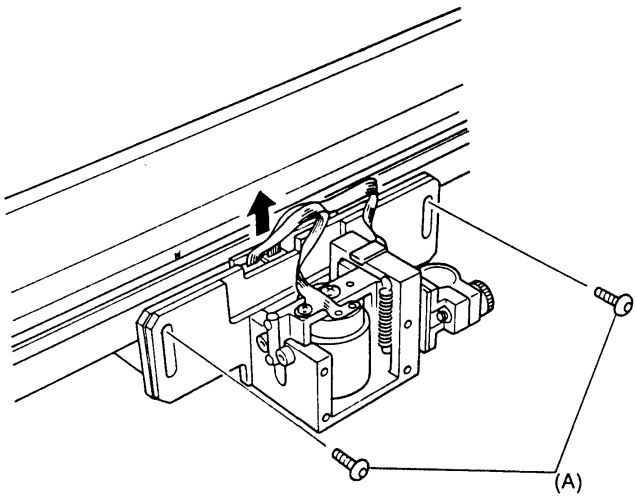
Remove the two M3 screws, then lift the cover up in the direction indicated by the arrow.



5.9.2 Removing the Pen Block

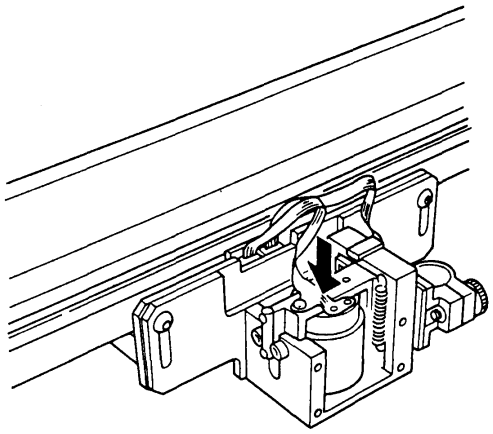
(1) Pull out the J1 (FPC10002) and J2 (FPC210099) FPC cables from their connectors on the PR223107 relay board in the direction indicated by the arrow.
(Before removal, be sure to make a memo indicating which cable goes to which connector.)

(2) When the two screws (A) are removed, the pen block can be removed.

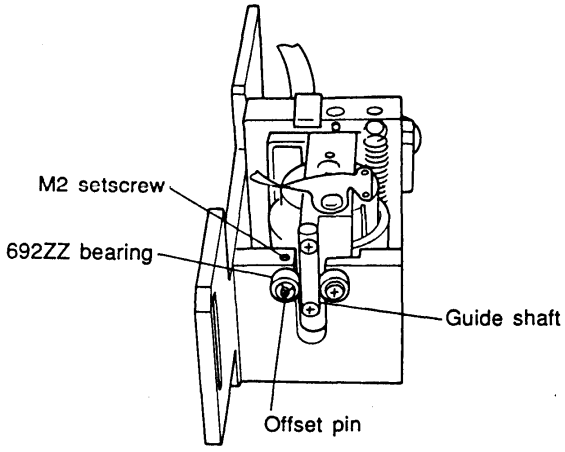


5.9.3 Adjusting the Pen Block

(1) When a force of 60 gf is applied by a push-pull gauge, the slide arm should lower smoothly to its lowest position.
If it does not lower smoothly, the pre-pressure of the 692ZZ bearing against the guide shaft may be too high. Also check for foreign matter on the parts concerned.
When the slide arm is pressed down by hand, it should lower smoothly.



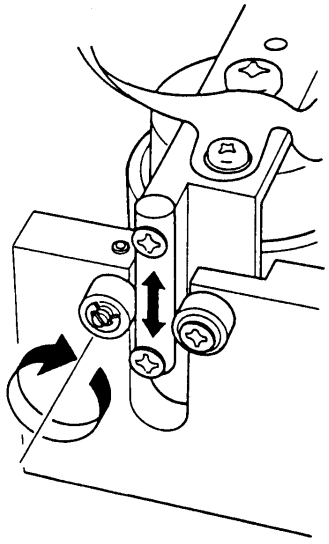
(2) If the slide arm does not lower smoothly, try performing the adjustment below.



- Loosen the M2 setscrew.
- Turn the offset pin to adjust the 692ZZ bearing to the position where there is no gap.
- Secure with the M2 setscrew.

(3) Checking the guide shaft and bearing adjustment.

- Raise or lower the guide shaft of the slide arm and confirm that the 692ZZ bearing rotates smoothly.

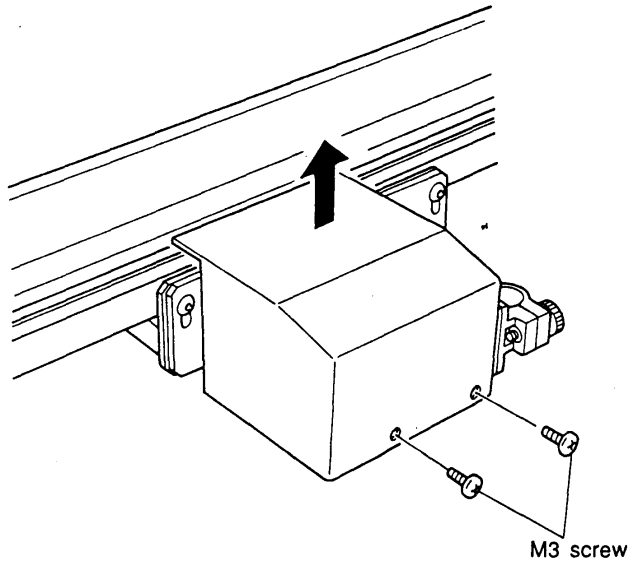


- If there is still play, there may be play between the guide shaft and 692ZZ bearing of the slide arm. Replace the pen block assembly.

5.10 Pen Block (Two-Pen Specifications)

5.10.1 Removing the Pen Block Cover

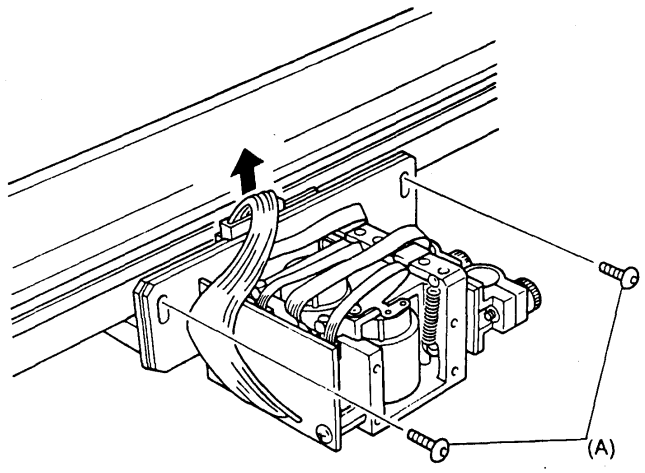
(1) Remove the two M3 screws, then lift the cover up in the direction indicated by the arrow.



5.10.2 Removing the Pen Block

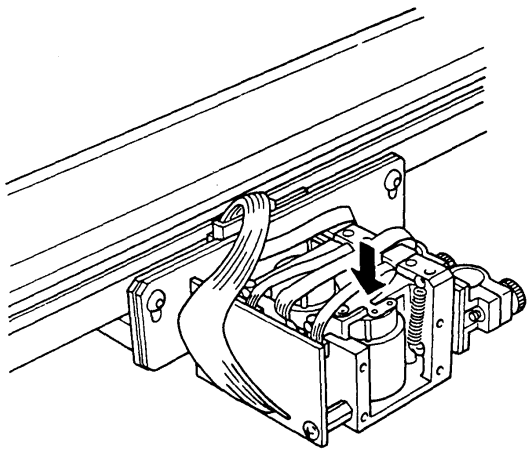
(1) Pull out the CA2292-39 cable from its connector on the PR22 relay board in the direction indicated by the arrow.

(2) When the two screws (A) are removed, the pen block can be removed.

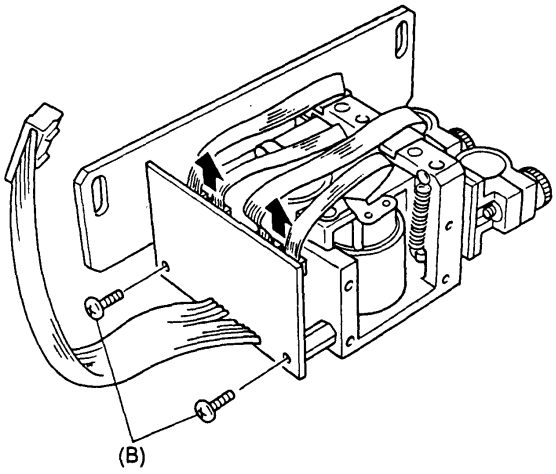


5.10.3 Adjusting the Pen Block

(1) When a force of 60 gf is applied by a push-pull gauge, the slide arm should lower smoothly to its lowest position.
If it does not lower smoothly, the pre-pressure of the 692ZZ bearing against the guide shaft may be too high. Also check for foreign matter on the parts concerned.
When the slide arm is pressed down by hand, it should lower smoothly.

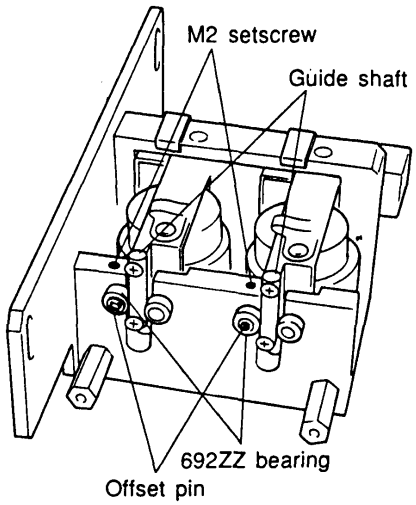


(2) If the slide arm does not lower smoothly, pull out the J21 (FPC210099) and J22 (FPC10002) FPC cables from their connectors on the PR22 relay board in the direction indicated by the arrow. Remove the two screws (B) to remove the relay board.



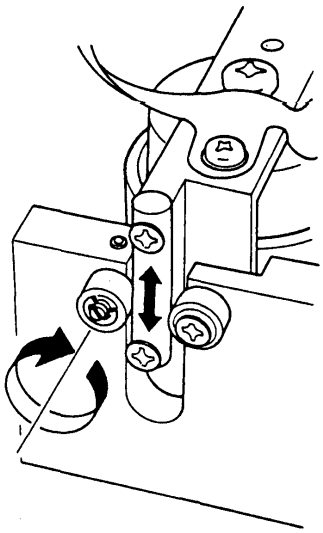
(3) Perform the adjustment below.

- Loosen the M2 setscrews.
- Turn the offset pins to adjust the 692ZZ bearings to the position where there is no gap.
- Secure with M2 setscrews.



(4) Checking the guide shaft and bearing adjustment.

- Raise or lower the guide shaft of the slide arm and confirm that the 692ZZ bearing rotates smoothly.



- If there is still play, there may be play between the guide shaft and 692ZZ bearing of the slide arm. Replace the pen block assembly.

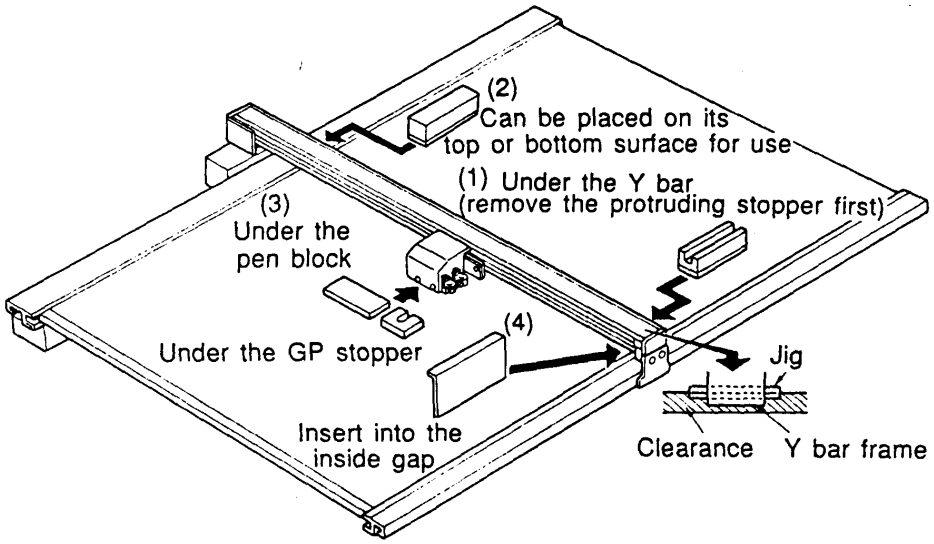
5.11 Using the Mechanical Adjustment Jigs

(1) Y bar height adjustment jig (front of plotter)

(2) Y bar height adjustment jig (rear of plotter)

(3) Pen block height adjustment jig (standard accessory)

(4) X slider F (Y bar frame) clearance adjustment jig

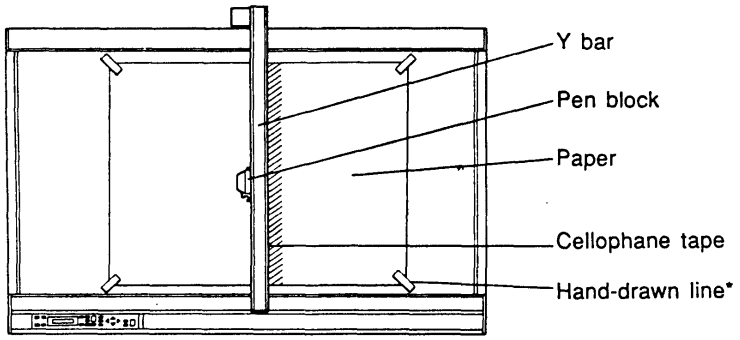


5.12 Replacing the Y Bar

5.12.1 Preparations

(1) Before replacing the Y bar, place a sheet of paper on the writing panel and secure it with cellophane tape.

(2) Move the Y bar to the center of the paper and lower the pen to manually draw a line down the length of the bar.



* This line will serve as a guideline for determining perpendicularity after the Y bar is remounted.

5.12.2 Replacing the Y Bar

Make sure that the plotter is turned off.

(1) Remove the pen block which is attached to the Y bar.

(2) Remove the Y bar.

(3) Attach a new Y bar.

- Temporarily attach the Y bar along the line drawn in Step (2) of subsection 5.12.1, "Preparations."
- After using the two Y bar height adjustment jigs and Y bar frame clearance adjustment jig to adjust the position of the Y bar, secure the Y bar in place.

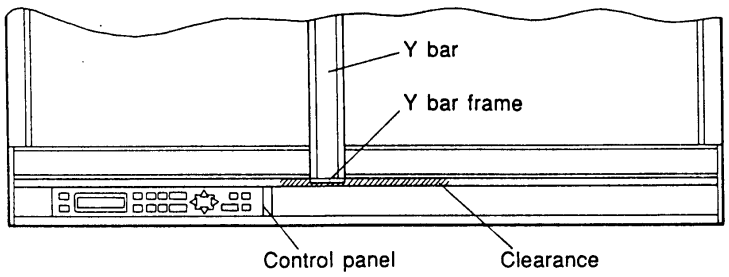
(4) Mount the pen block, which was removed in Step (1) above, onto the new Y bar.

- After using the pen block adjustment jig to adjust the height of the pen block, secure the pen block in place.

NOTE: When the Y bar is moved manually from side to side while the plotter is turned off, be sure to detach the three connectors which connect the control box to the plotter's main unit. Failure to remove these connectors may cause the gears to slip or not mesh properly.

5.12.3 Checking the Sliding of the Y Bar Frame (Manual Check)

(1) Insert the clearance adjustment jig at the front of the Y bar frame to confirm that the frame clearance is approximately identical at the front and rear of the writing panel. While moving the Y bar in the X-axis direction, make sure that no abnormal sound is generated as a result of the Y bar making contact with the Y bar frame.



(2) Other adjustments of the Y bar frame

- Loosen the screw located on the bottom plate of the control panel, then pull the control panel assembly toward you to increase the clearance.
- When the front and back clearances of the Y bar frame are identical, readjust the height of the Y bar.
- After adjustment, gently slide the Y bar within its movable range to confirm that no abnormal sound is generated.

> **NOTE:** Before moving the Y bar by hand, be sure to detach the three connectors which connect the control box to the plotter's main unit.

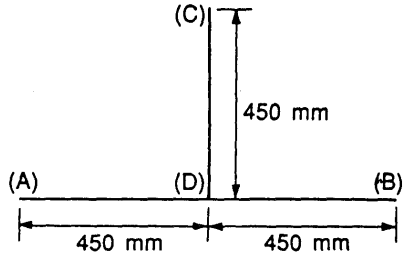
- Next, re-connect the three connectors, turn on the plotter, and press the VIEW key to check the operation of the Y bar within the effective plotting area.

5.13 Adjusting the Perpendicularity Precision

5.13.1 Checking the Deviation in the Perpendicularity

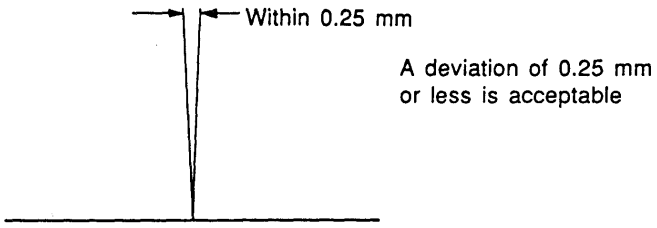
(1) Load a thin sheet of paper on the writing panel and attach a plotter pen (0.2 mm ceramic pen) to the pen holder.

(2) Manually move the pen to plot the pattern shown in the figure below.

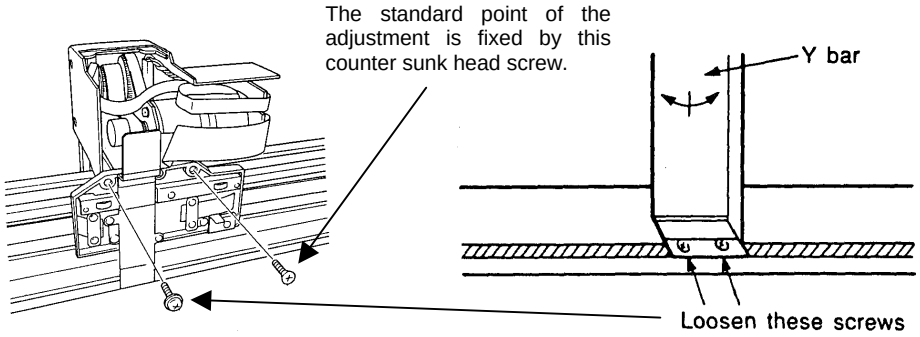


(3) Turn the sheet over and load it so that points (A) and (B) on the other side are parallel to the X axis.

(4) After positioning the pen on point (D), draw a line to point (C). Check if there is any deviation between the lines between points (D) and (C) on the front and back of the sheet.

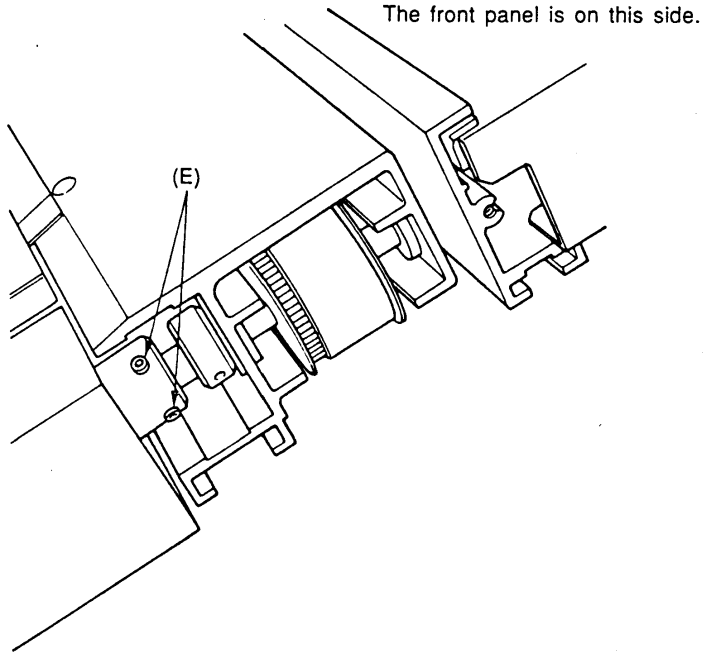


(5) If the deviation exceeds 0.25 mm, loosen the screws at the top and bottom of the Y bar and adjust the vertical orientation of the Y bar by moving it toward the pertinent side.



(6) Repeat Steps (1) to (4) above to confirm the precision of the perpendicularity.

(7) If the perpendicularity cannot be satisfactorily adjusted by performing the preceding Steps (1) to (6), repeat adjustment after loosening the two 3 mm setscrews indicated by the (E) arrows.



5.14 Replacing the Electrostatic Adhesion Plate

(This operation requires three persons.)

5.14.1 Peeling Off the Electrostatic Adhesion Plate

(1) Turn off the power and remove the high-voltage power supply cable connectors (P34 and J34) at the rear of the writing panel.

(2) Remove the Y bar. (See section 5.3, "Adjusting the Y slider".)

(3) Cut into the electrostatic adhesion plate at intervals (50-100 mm) that will make it easy to peel off the electrostatic adhesion plate. If this scratches the aluminum plate underneath, polish away the unevenness with #1500 sandpaper.

(4) Peel off the electrostatic adhesion plate, using force if necessary. Using pliers or the like makes it easy.

(5) Remove any remaining double-sided tape and glue. Sprinkle on ECT-1 toner cleaning fluid (available from Graphtec) and leave for 1 or 2 minutes. Scrape off with some sort of scraper (e.g. spatula).

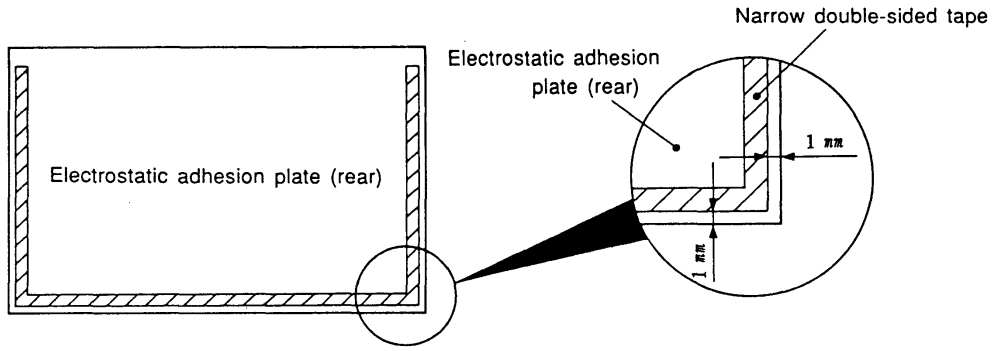
(6) When everything has been removed from the aluminum plate, wipe it off with ethyl alcohol.

5.14.2 Preliminary Preparations for Pasting On New Plate

(1) Wipe off the front and rear surfaces of the electrostatic adhesion plate with ethyl alcohol to remove any dirt and dust.

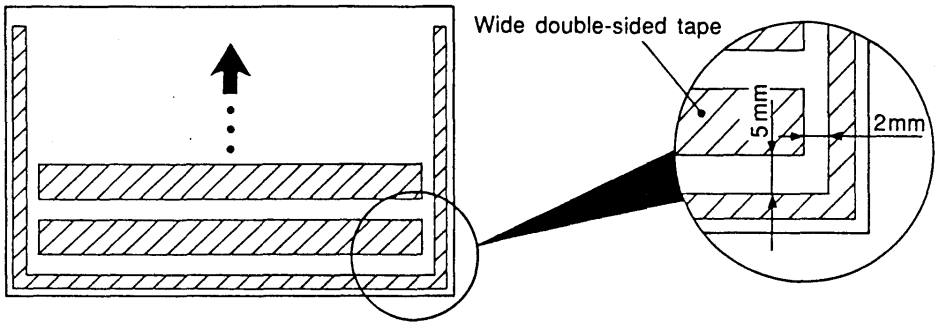
(2) Prepare pieces of double-sided tape of various widths* and paste them on to the rear surface of the electrostatic adhesion plate following the procedure below.

- Using narrow double-sided tape, make a border around three sides of the electrostatic adhesion plate (leaving one of the longer sides untaped). (Leave 1 mm open between the tape and the edge of the electrostatic adhesion plate.)



NOTE: Never let the tape overlap!

- Tape on lengthwise strips of wide double-sided tape at intervals of 5 mm.



NOTE: Never let the tape overlap!

Tape on the double-sided tape in such a way that the gap is as negligible as possible at the high-voltage power supply cable installation section.

- Finally, use a combination of wide and narrow double-sided tape so that there is no untaped interval greater than 5 mm.

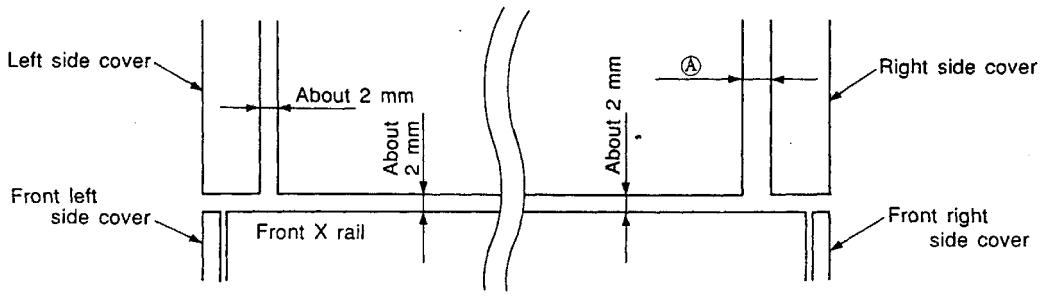
NOTE: Never let the tape overlap!

* "Pieces of double-sided tape of various widths" means tape of 120, 20, 10, 5 mm width at the production stage. If it is difficult to prepare pieces of tape of these widths, use double-sided tape as close to these widths as possible.

5.14.3 Attaching the Electrostatic Adhesion Plate

(1) Temporarily fasten the side cover, line up the holes for the high-voltage power supply cable on the writing panel and the electrostatic adhesion plate and position according to the following conditions.

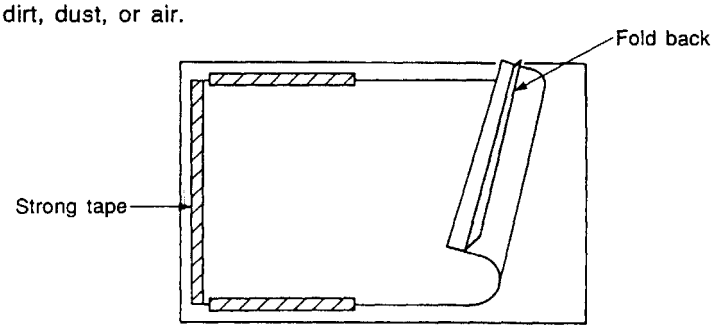
- Use the origin side (front X rail side and left side cover side) as the reference.
- Position about 2 mm from the origin side as in the figure below.



- Since there are slight differences in the size of electrostatic adhesion plates, the dimensions are not specified with great precision.
- A in the diagram above is not 2 mm.
- Be careful not to let any dirt or dust get under the electrostatic adhesion plate during positioning.

(2) Secure the origin side with strong tape.

(3) Peel off and fold back the backing sheet of the double-sided tape at the high-voltage power supply cable side for about 100 mm and paste on without letting in any dirt, dust, or air.



(4) Peel off the strong tape used for securing in Step (1) above, and while one person holds the origin side and checks for and points out any unevenness, the other two persons peel off the double-sided tape backing sheet and paste on by sliding their hands along.

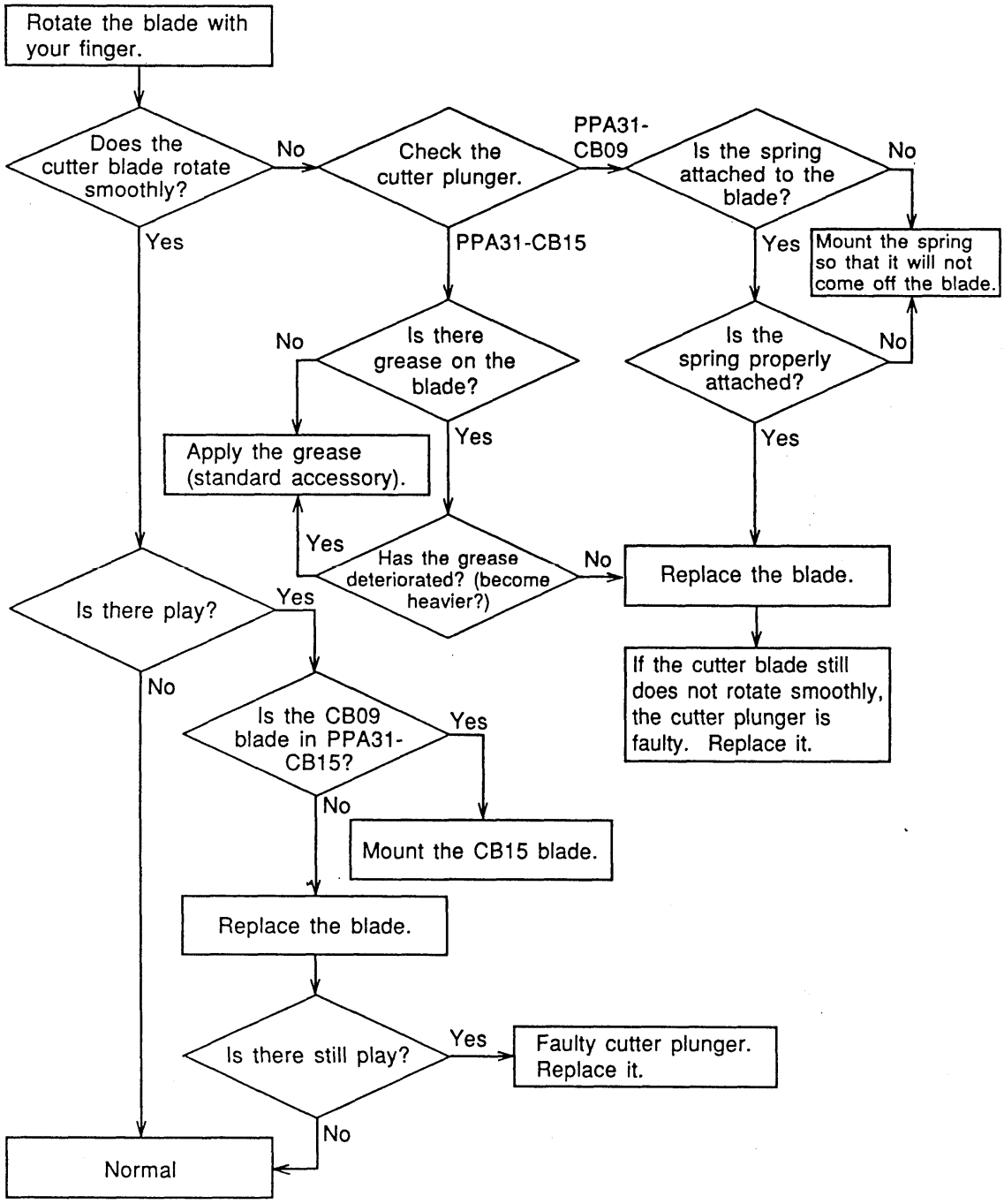
- If dust or dirt gets in, remove it with tweezers or your fingernail tips.
- If air gets in, drive out the air at 5 mm intervals by kneading softly.

(5) When the entire surface has been spread out, attach it by sliding your hand across it again and pressing it.

6. TROUBLESHOOTING FLOWCHARTS

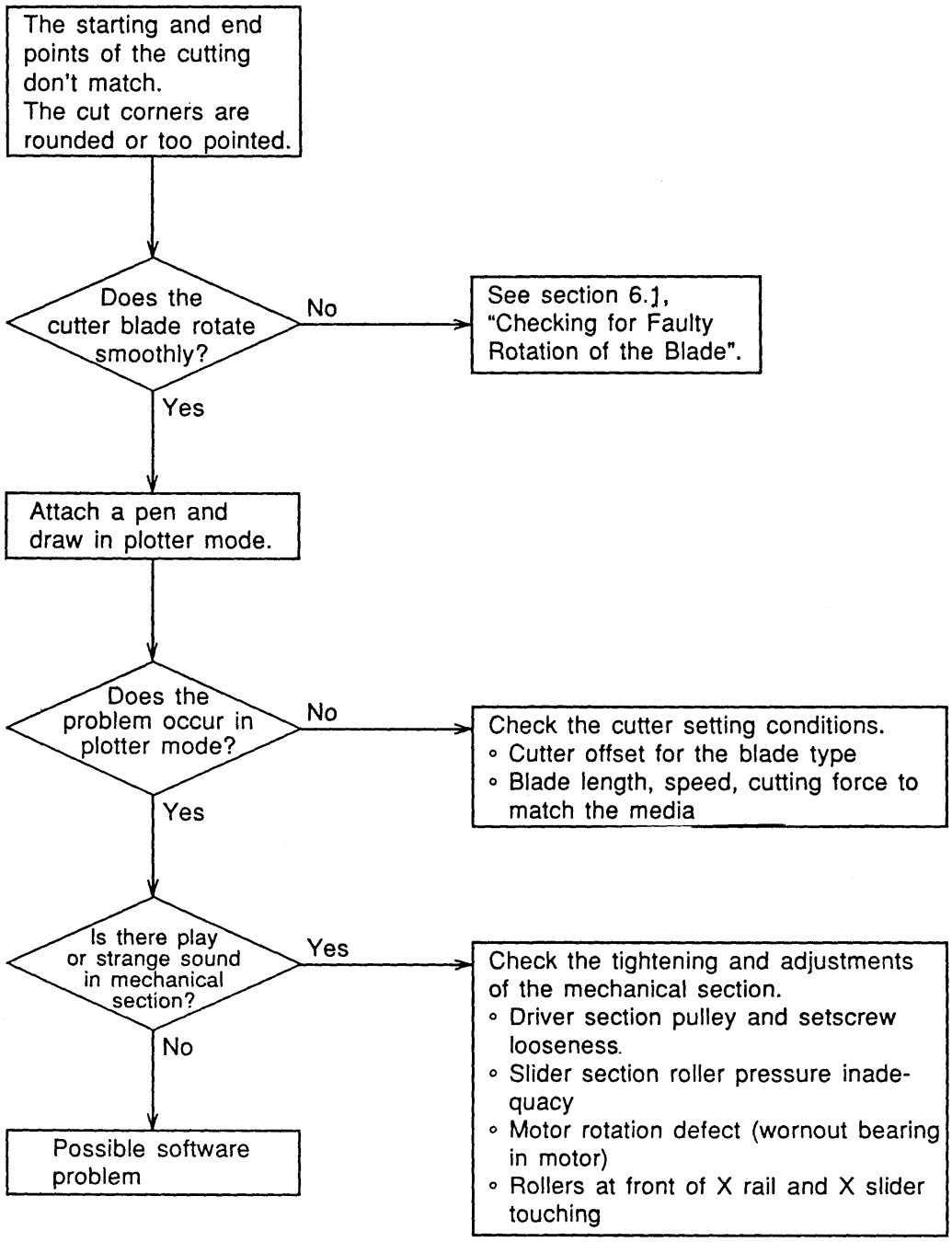
6.1 Checking for Faulty Rotation of the Blade

Cutting cannot be properly performed if the blade mounted in the holder does not rotate smoothly or if there is play between the holder and blade because their diameters do not match.
Use the flowchart below to check for faulty rotation of the blade.

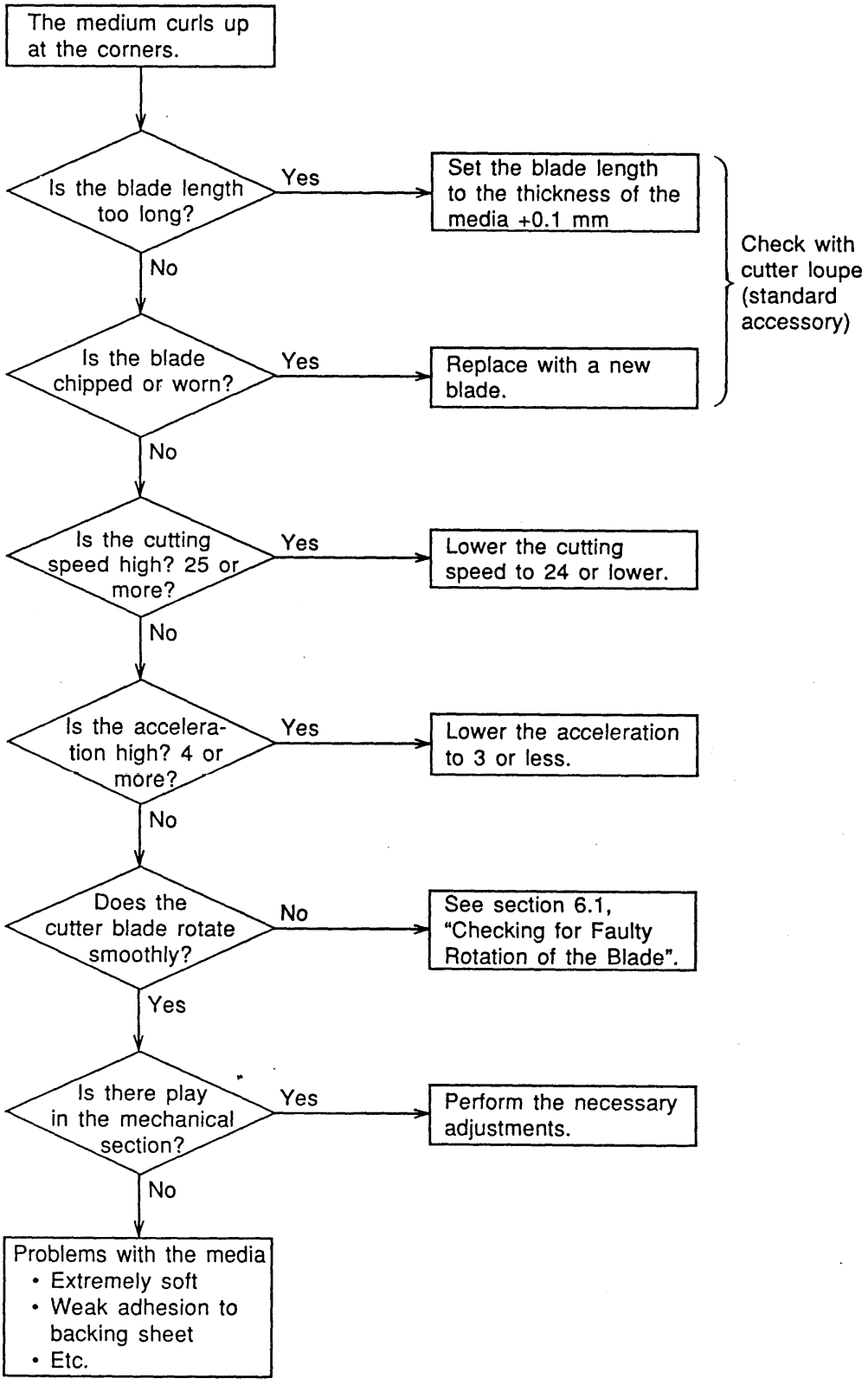


6.2 The Cutting Media Cannot be Satisfactorily Cut

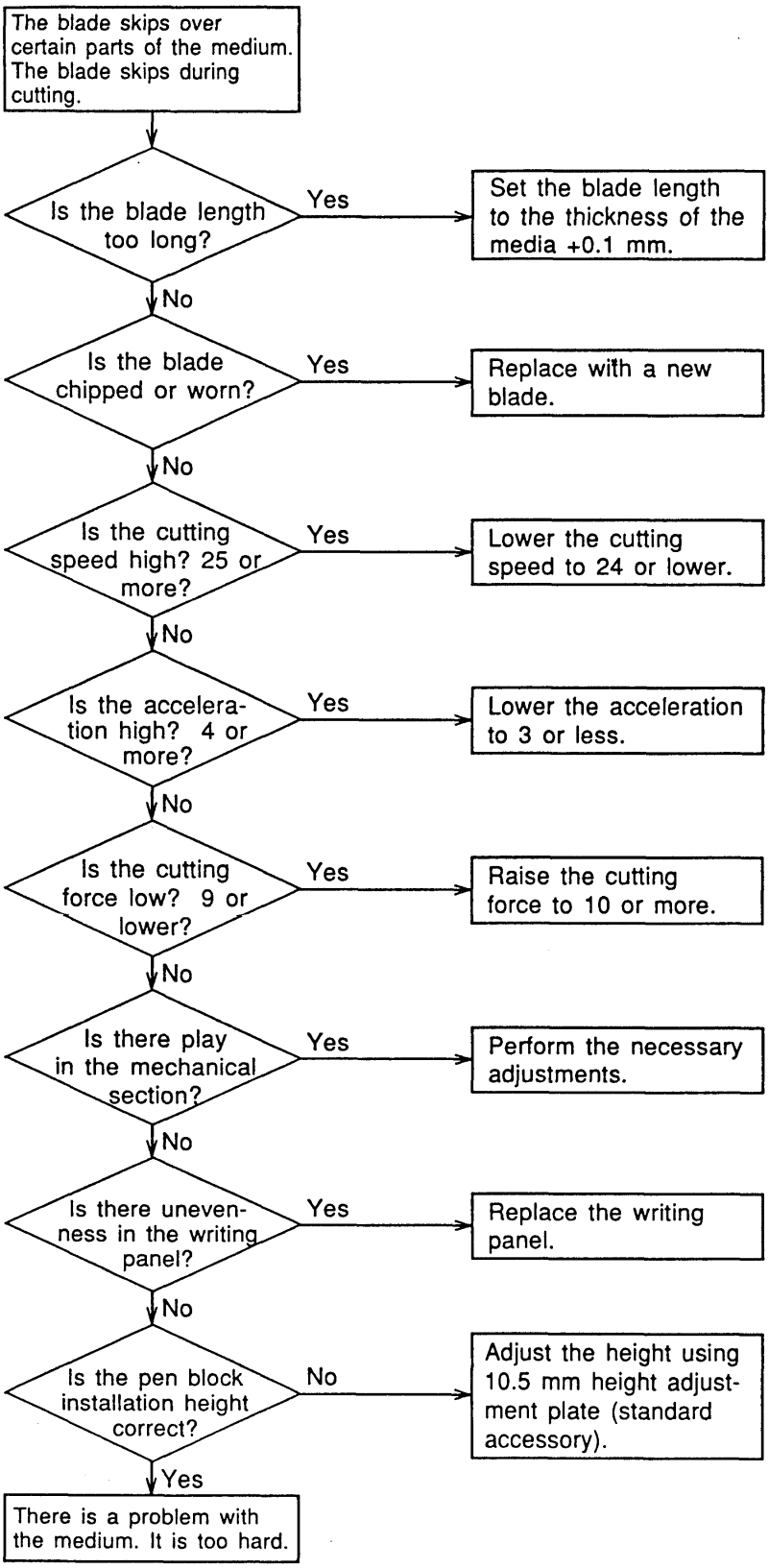
Part 1:


The starting and end points of the cutting don't match.
The cut corners are rounded or too pointed.
Does the cutter blade rotate smoothly?
No
See section 6.1, "Checking for Faulty Rotation of the Blade".
Yes
Attach a pen and draw in plotter mode.
Does the problem occur in plotter mode?
No
Check the cutter setting conditions.
∘ Cutter offset for the blade type
∘ Blade length, speed, cutting force to match the media
Yes
Is there play or strange sound in mechanical section?
Yes
Check the tightening and adjustments of the mechanical section.
∘ Driver section pulley and setscrew looseness.
∘ Slider section roller pressure inadequacy
∘ Motor rotation defect (wornout bearing in motor)
∘ Rollers at front of X rail and X slider touching
No
Possible software problem

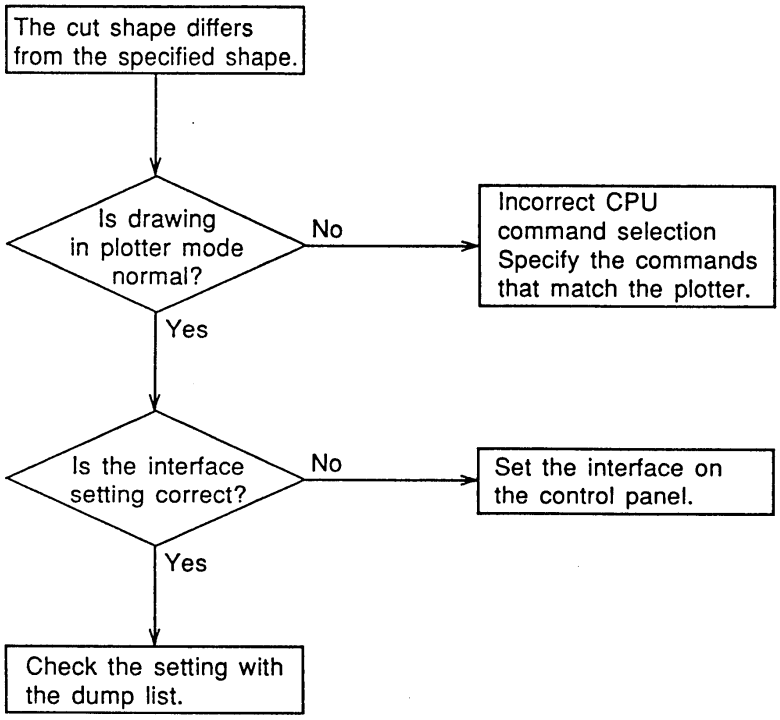
The Cutting Media Cannot be Satisfactorily Cut
Part 2:


The medium curls up at the corners.
Is the blade length too long?
Yes
Set the blade length to the thickness of the media +0.1 mm
No
Is the blade chipped or worn?
Yes
Replace with a new blade.
Check with cutter loupe (standard accessory)
No
Is the cutting speed high? 25 or more?
Yes
Lower the cutting speed to 24 or lower.
No
Is the accelera-tion high? 4 or more?
Yes
Lower the acceleration to 3 or less.
No
Does the cutter blade rotate smoothly?
No
See section 6.1, "Checking for Faulty Rotation of the Blade".
Yes
Is there play in the mechanical section?
Yes
Perform the necessary adjustments.
No
Problems with the media
• Extremely soft
• Weak adhesion to backing sheet
• Etc.

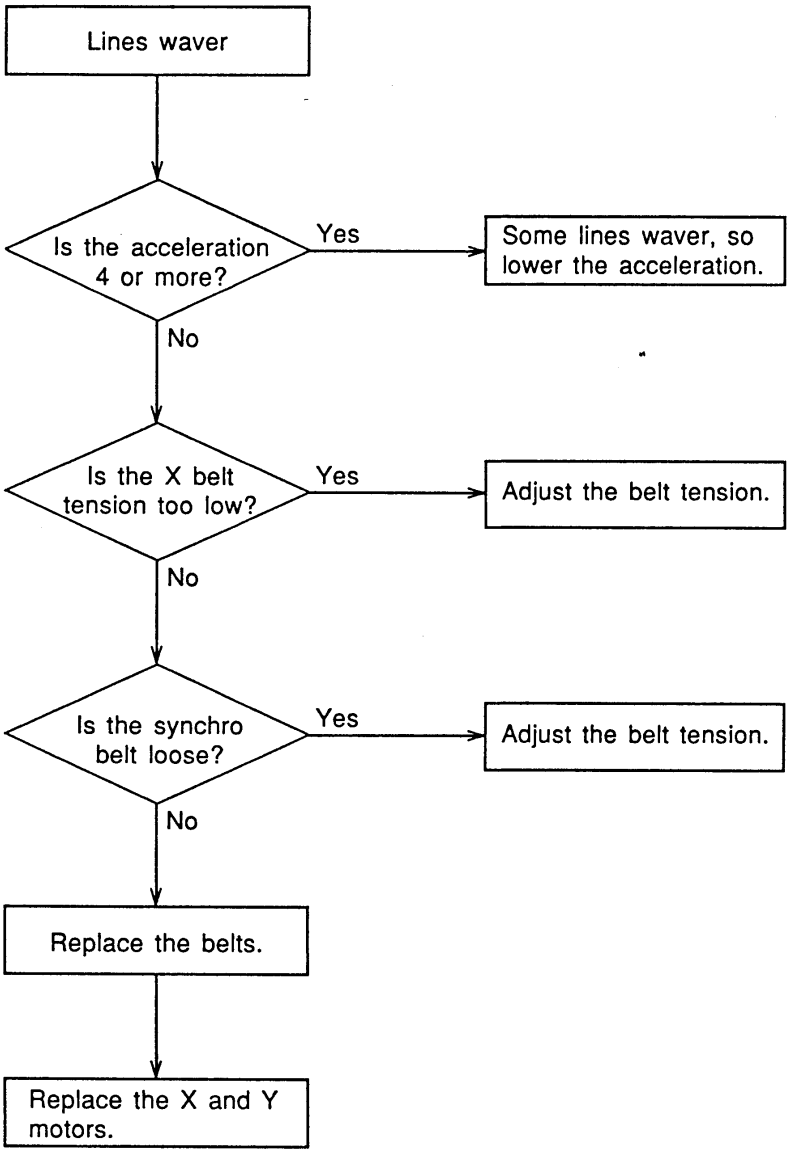
The Cutting Media Cannot be Satisfactorily Cut
Part 3:


The blade skips over certain parts of the medium. The blade skips during cutting.
Is the blade length too long?
Yes
Set the blade length to the thickness of the media +0.1 mm.
No
Is the blade chipped or worn?
Yes
Replace with a new blade.
No
Is the cutting speed high? 25 or more?
Yes
Lower the cutting speed to 24 or lower.
No
Is the accelera-tion high? 4 or more?
Yes
Lower the acceleration to 3 or less.
No
Is the cutting force low? 9 or lower?
Yes
Raise the cutting force to 10 or more.
No
Is there play in the mechanical section?
Yes
Perform the necessary adjustments.
No
Is there uneven-ness in the writing panel?
Yes
Replace the writing panel.
No
Is the pen block installation height correct?
No
Adjust the height using 10.5 mm height adjust-ment plate (standard accessory).
Yes
There is a problem with the medium. It is too hard.

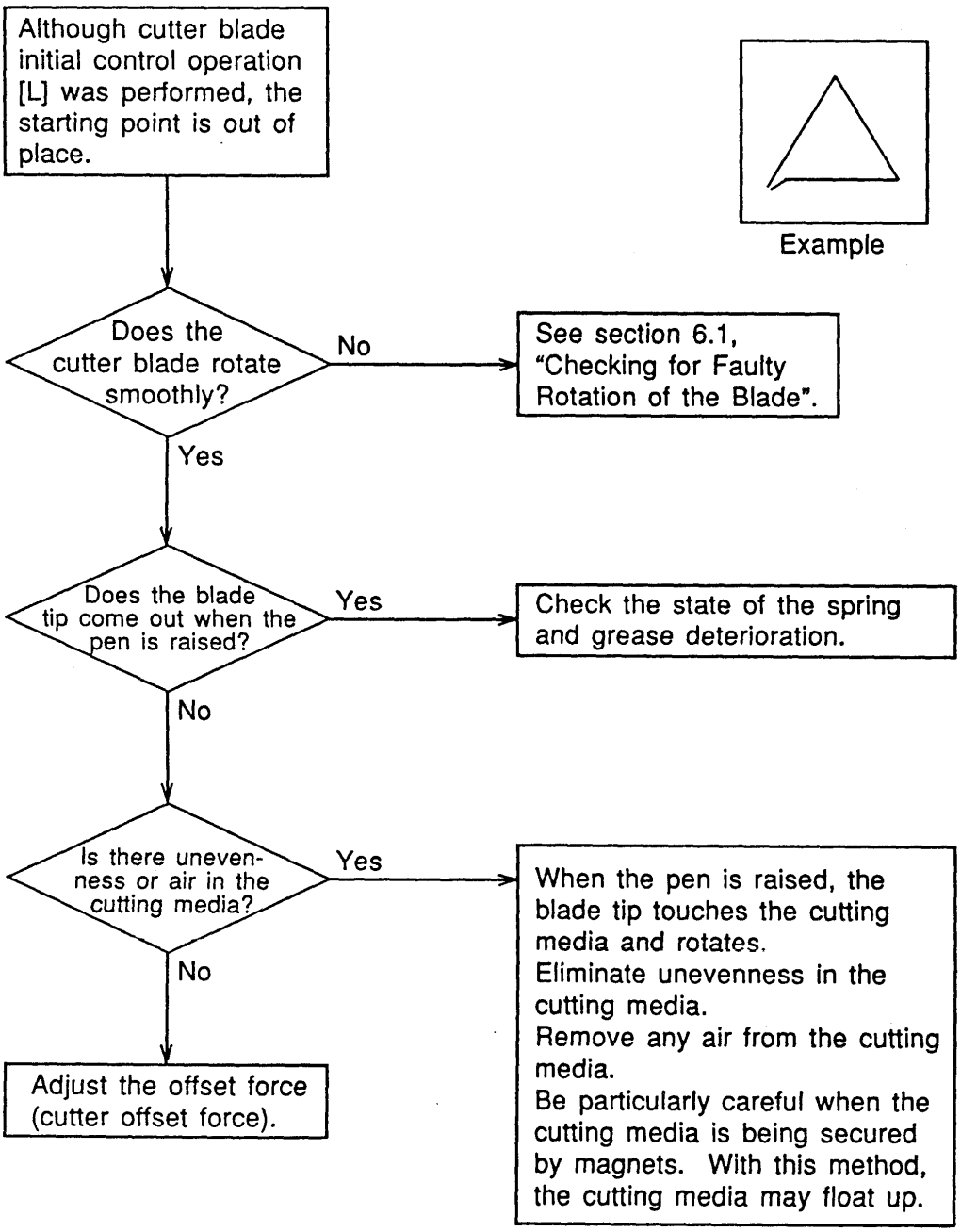
The Cutting Media Cannot be Satisfactorily Cut
Part 4:


The cut shape differs from the specified shape.
Is drawing in plotter mode normal?
No
Incorrect CPU command selection Specify the commands that match the plotter.
Yes
Is the interface setting correct?
No
Set the interface on the control panel.
Yes
Check the setting with the dump list.

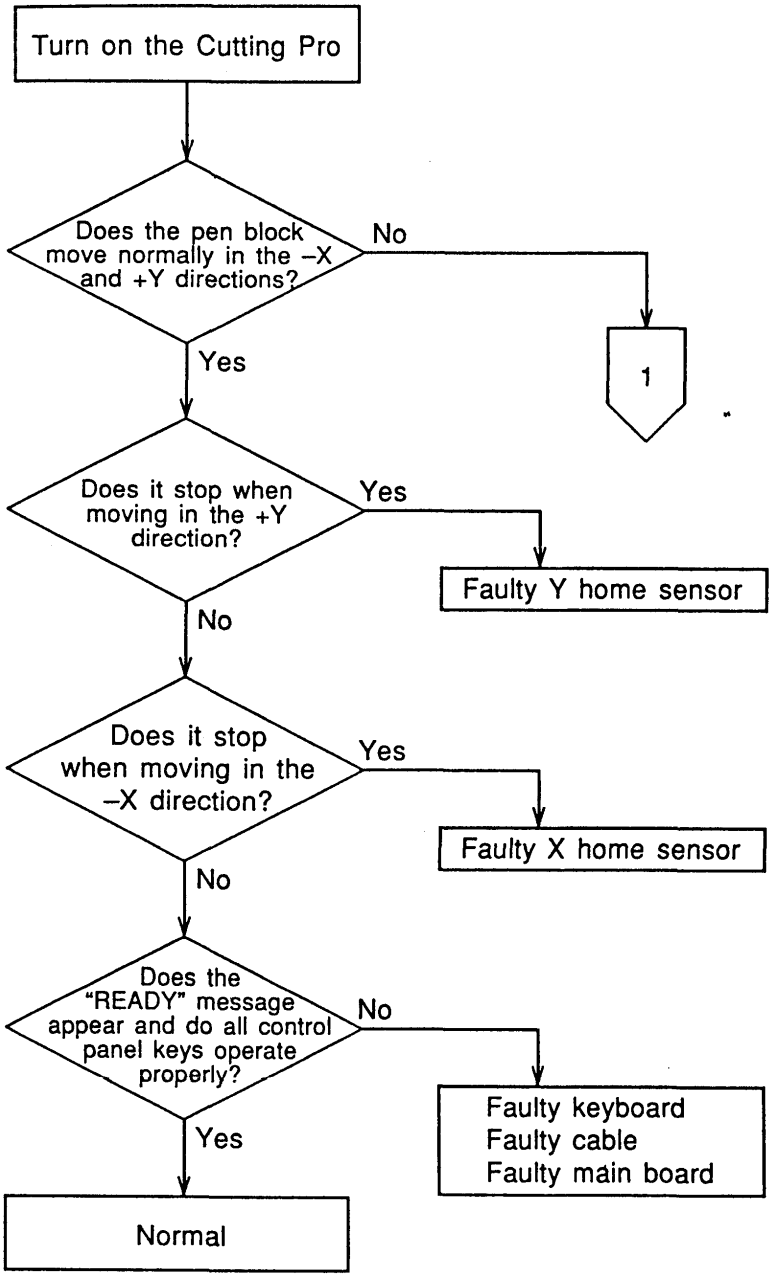
The Cutting Media Cannot be Satisfactorily Cut
Part 5:

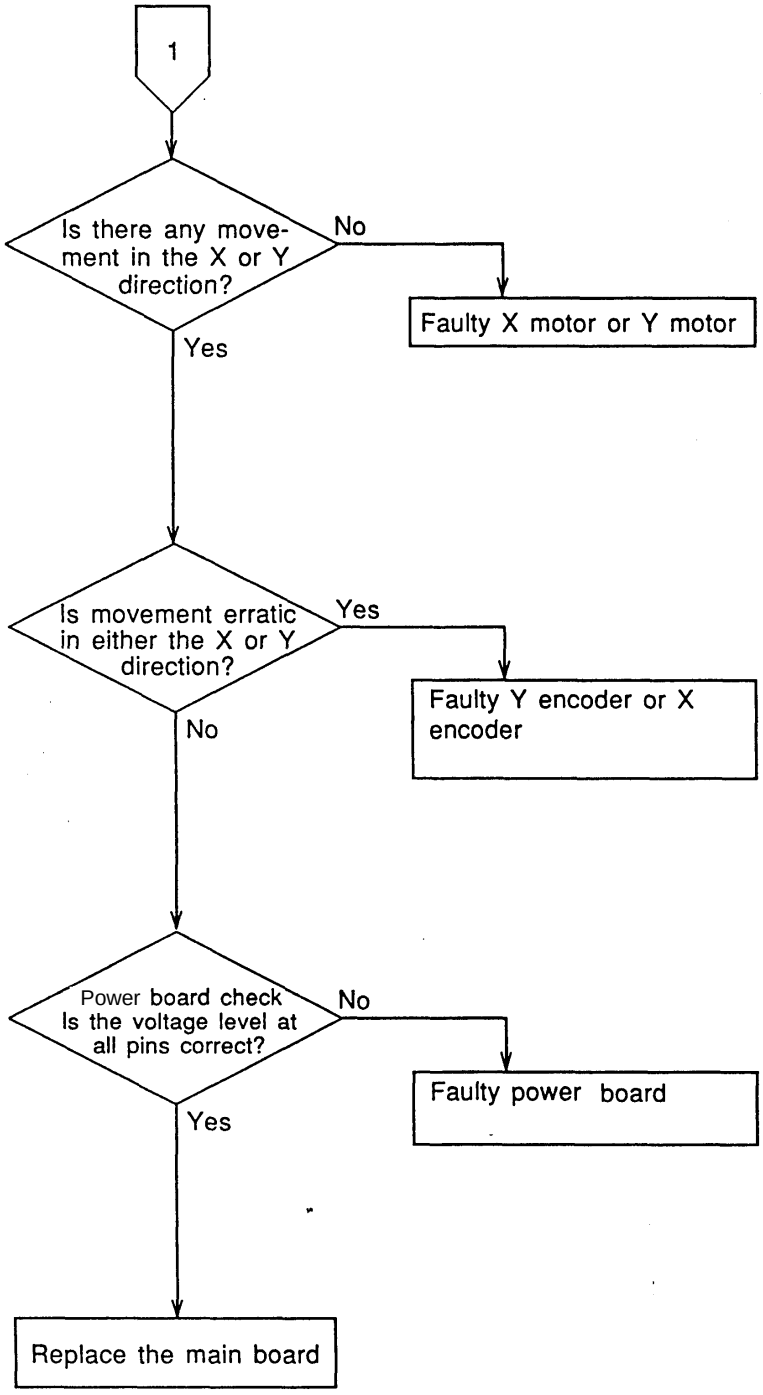


The Cutting Media Cannot be Satisfactorily Cut
Part 6:


Although cutter blade initial control operation [L] was performed, the starting point is out of place.
Example
Does the cutter blade rotate smoothly?
No
See section 6.1, "Checking for Faulty Rotation of the Blade".
Yes
Does the blade tip come out when the pen is raised?
Yes
Check the state of the spring and grease deterioration.
No
Is there unevenness or air in the cutting media?
Yes
When the pen is raised, the blade tip touches the cutting media and rotates.
Eliminate unevenness in the cutting media.
Remove any air from the cutting media.
Be particularly careful when the cutting media is being secured by magnets. With this method, the cutting media may float up.
No
Adjust the offset force (cutter offset force).

6.3 Initialization is Abnormal

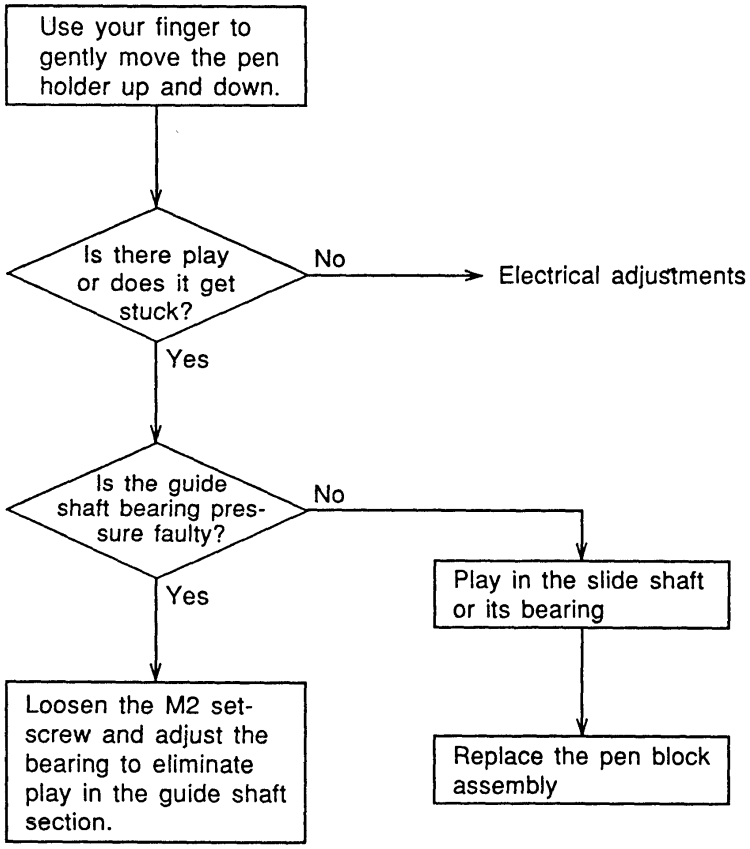



1
Is there any move-ment in the X or Y direction?
No
Faulty X motor or Y motor
Yes
Is movement erratic in either the X or Y direction?
Yes
Faulty Y encoder or X encoder
No
Power board check Is the voltage level at all pins correct?
No
Faulty power board
Yes
Replace the main board

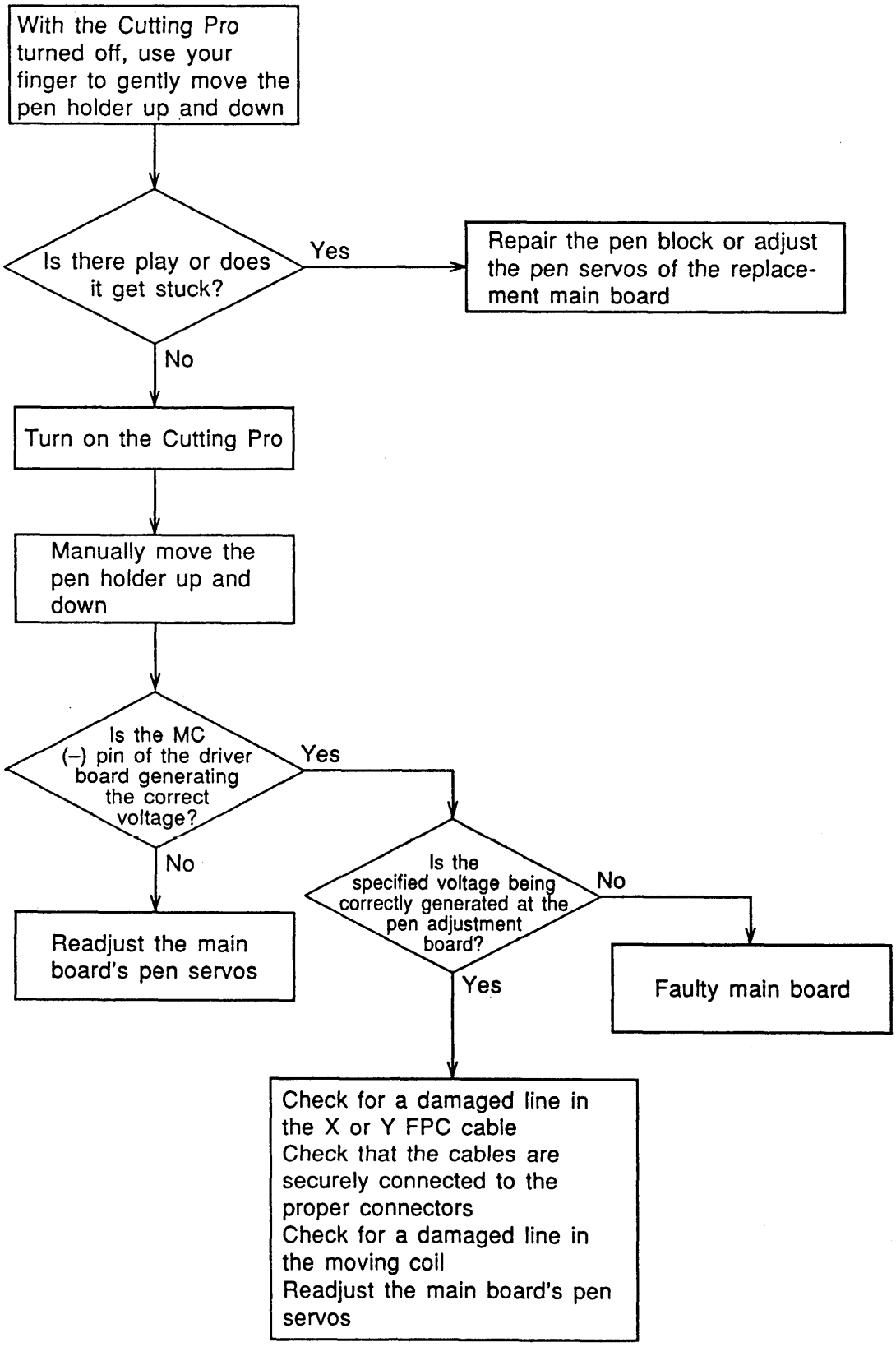
6.4 Pen UP/DOWN Operations are Abnormal

Be sure to turn off the Cutting Pro before performing the following checking procedures.

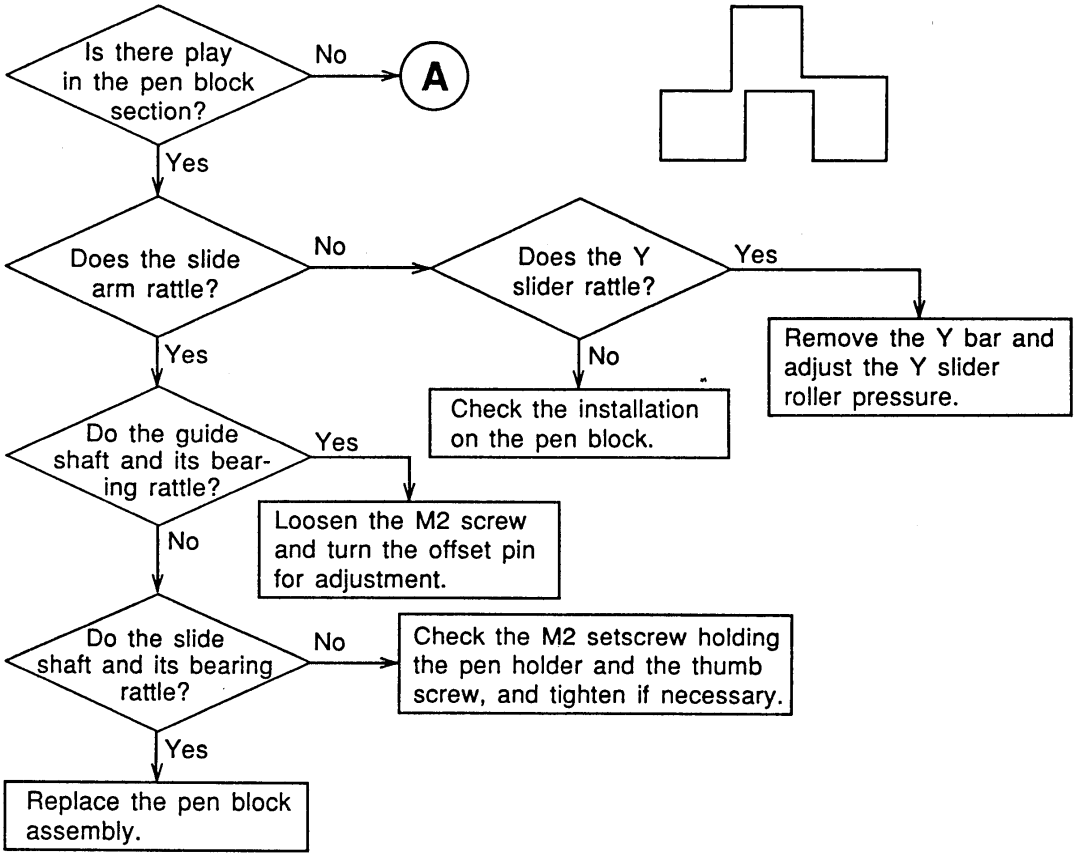
Part 1:

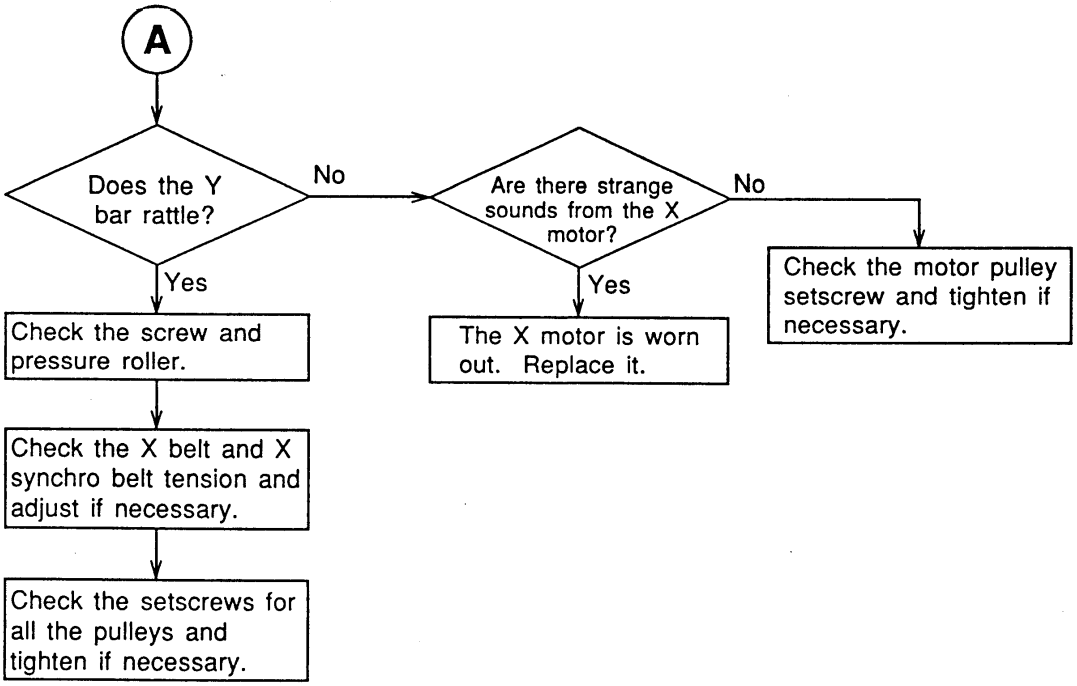

Use your finger to gently move the pen holder up and down.
Is there play or does it get stuck?
No
Electrical adjustments
Yes
Is the guide shaft bearing pressure faulty?
No
Play in the slide shaft or its bearing
Yes
Loosen the M2 set-screw and adjust the bearing to eliminate play in the guide shaft section.
Replace the pen block assembly

Pen UP/DOWN Operations is Abnormal
Part 2:

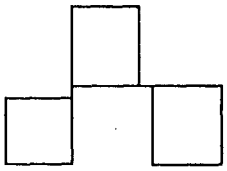

With the Cutting Pro turned off, use your finger to gently move the pen holder up and down
Is there play or does it get stuck?
Yes
Repair the pen block or adjust the pen servos of the replacement main board
No
Turn on the Cutting Pro
Manually move the pen holder up and down
Is the MC (–) pin of the driver board generating the correct voltage?
Yes
No
Readjust the main board's pen servos
Is the specified voltage being correctly generated at the pen adjustment board?
No
Faulty main board
Yes
Check for a damaged line in the X or Y FPC cable
Check that the cables are securely connected to the proper connectors
Check for a damaged line in the moving coil
Readjust the main board's pen servos

6.5 The X-Axis Backlash is Excessive


Is there play in the pen block section?
No
A
Yes
Does the slide arm rattle?
No
Does the Y slider rattle?
Yes
Remove the Y bar and adjust the Y slider roller pressure.
Yes
No
Check the installation on the pen block.
Do the guide shaft and its bear-ing rattle?
Yes
Loosen the M2 screw and turn the offset pin for adjustment.
No
Do the slide shaft and its bearing rattle?
No
Check the M2 setscrew holding the pen holder and the thumb screw, and tighten if necessary.
Yes
Replace the pen block assembly.


A
Does the Y bar rattle?
No
Are there strange sounds from the X motor?
No
Check the motor pulley setscrew and tighten if necessary.
Yes
Yes
Check the screw and pressure roller.
The X motor is worn out. Replace it.
Check the X belt and X synchro belt tension and adjust if necessary.
Check the setscrews for all the pulleys and tighten if necessary.

6.6 The Y-Axis Backlash is Excessive



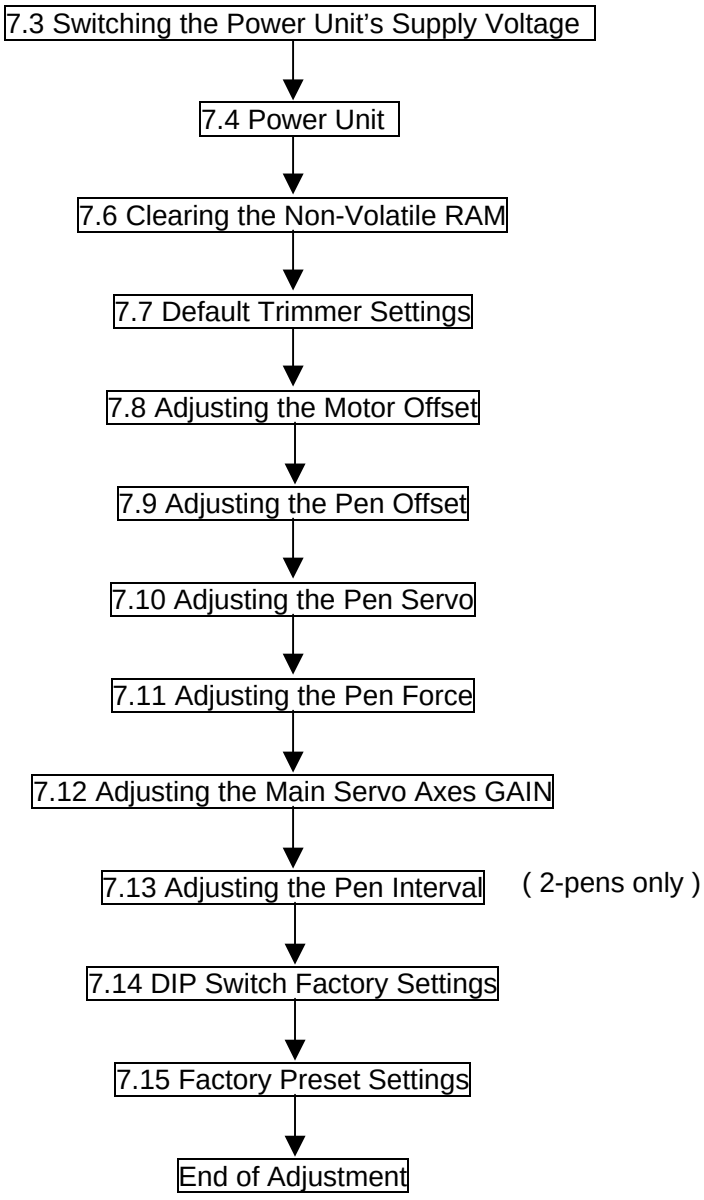
(1) Adjust the perpendicularity of the Y bar (see section 5.13, "Adjusting the Perpendicularity Precision").

(2) Adjust the Y belt tension.

7. ELECTRICAL ADJUSTMENTS

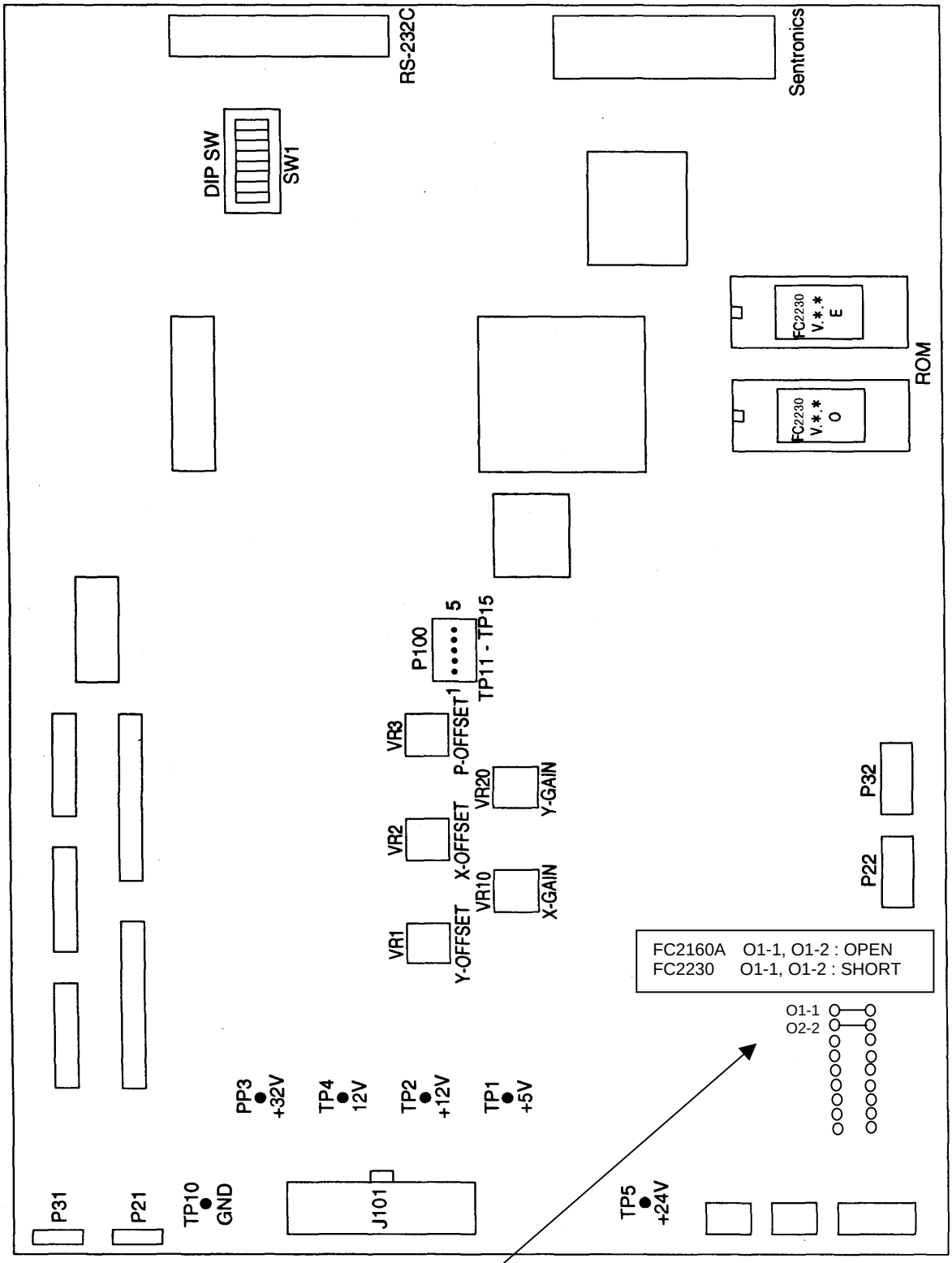
7.1 Flowchart of the Adjustment Sequence

Flowchart of the Adjustment Sequence for 1- and 2-pen Specifications of FC2231 and FC2232.


7.3 Switching the Power Unit's Supply Voltage
7.4 Power Unit
7.6 Clearing the Non-Volatile RAM
7.7 Default Trimmer Settings
7.8 Adjusting the Motor Offset
7.9 Adjusting the Pen Offset
7.10 Adjusting the Pen Servo
7.11 Adjusting the Pen Force
7.12 Adjusting the Main Servo Axes GAIN
7.13 Adjusting the Pen Interval
(2-pens only)
7.14 DIP Switch Factory Settings
7.15 Factory Preset Settings
End of Adjustment

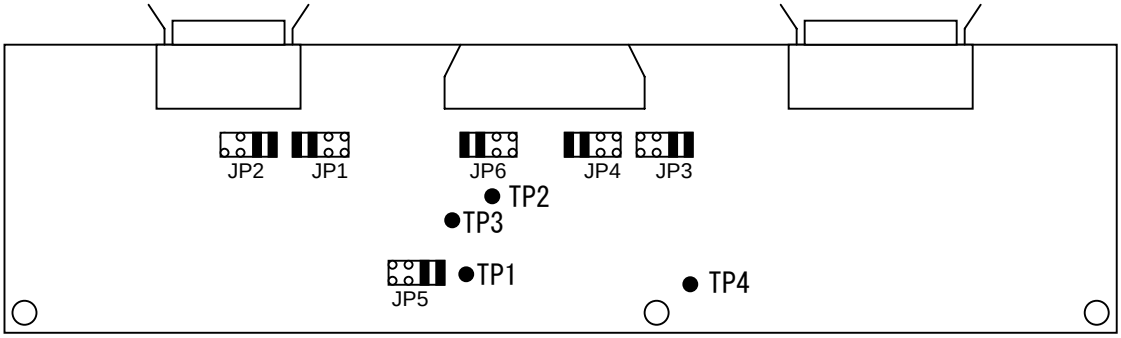
7.2 Location of the board

7.2.1 Main Board (PR216001)



NOTE: A modified main board has been used for the FC2230.
Jumper switches have been added.
The FC2230 board can be used for an FC2160A model, but an unmodefied FC2160A board can not be used for an FC2230 model.

7.2.1 Main Joint Board (PR223282)

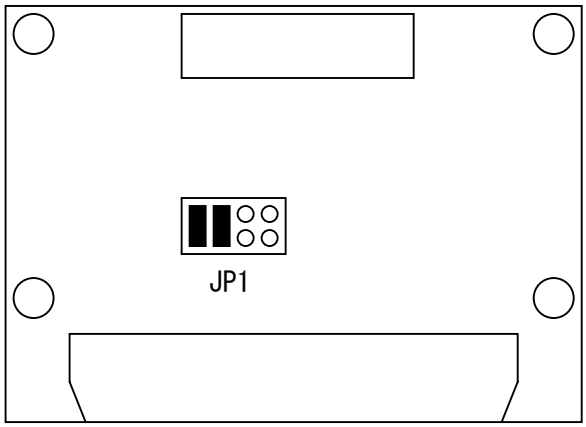


Jumper switch setting of JP6.

1 pen type.

2 pen type.

7.2.2 X Flex. Board (PR223224)



Jumper switch setting of JP6.

1 pen type.

2 pen type.

7.3 Power Unit (PS089 or PS089A)

7.3.1 Checking Operation

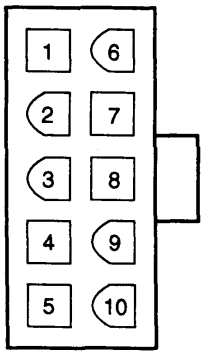
(1) Use a multimeter to check the voltage levels of TP1 to TP5.

	Voltage
TP1	+5V
TP2	+12V
TP3	+32V
TP4	-12V
TP5	+24V

(2) If voltage levels cannot be measured at TP1 to TP5, use the following method to check operation.

- Disconnect the main board's J101 connector.
- Next, use the multimeter to measure the voltage levels of the J101 connector pins.

	Voltage
1 pin	+5V
2 pin	+12V
3 pin	+32V
4 pin	GND
5 pin	GND
6 pin	+5V
7 pin	-12V
8 pin	+32V
9 pin	+32V
10 pin	GND



(3) If the measured voltage levels do not conform to the above tables, the power unit is probably defective.

7.3.2 The Protective Circuit

The protective circuit is activated in either of the following cases.

	32 V power	5 V power	+12V power	-12V power
Protection against excess current	8 A or more	6 A or more	6 A or more	3A or more
Protection against excess current	115% of the rated voltage (32 V)	———	———	———

When the protective circuit is activated, all of the plotter's supply voltages are switched off.

If the protective circuit is activated, turn off the plotter. After the plotter is left as is for three to five minutes, it will automatically recover.

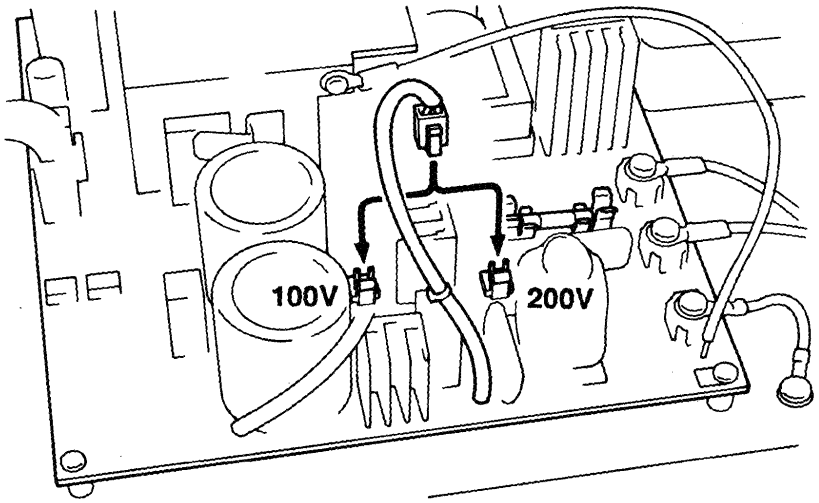
7.4 Switching the Power Unit's Supply Voltage

(1) Check that the plotter's POWER switch is off.

(2) **Upper Chassis of the control unit is opened.**

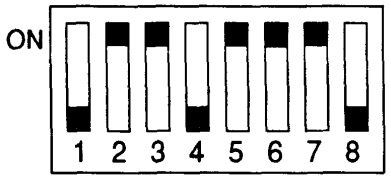
(3) Connect the power unit's cable to the required connector.

Voltage series	Corresponding area	Connector
100 V	JAP 110T/K WGI117UL	CN2
200 V	CEE SEV BS AS	CN3



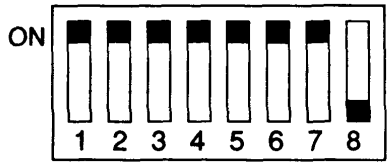
7.5 Setting the DIP Switches

Settings for the DIP Switch on the Main Board



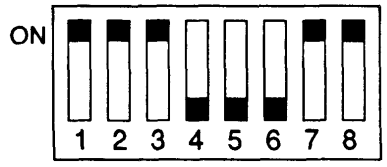
The NOVRAM CLEAR function

- Initializes the main board by clearing the non-volatile RAM
- Execute this function before starting any electrical adjustment



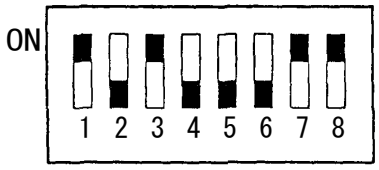
Servo D/A ZERO OUT

- Offset adjustment of the X and Y motors
- Pen offset adjustment



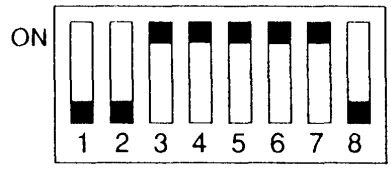
Electrical adjustments

- Pen height adjustment (1-pen only)
- Pen force adjustment
- Selection of Centronics compatible interface mode

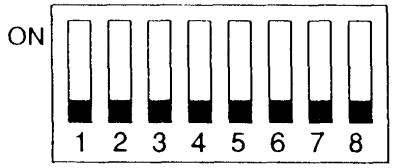


Electrical adjustment

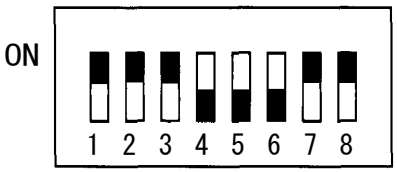
- **Pen height adjustment (2-pen only)**



Sensor Test Mode



Keyboard Test Mode



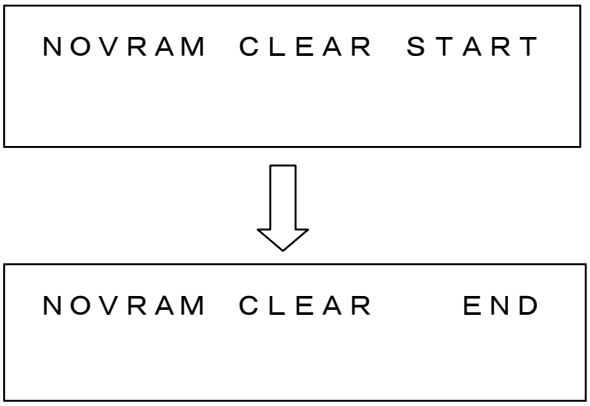
Parallel Interface

7.6 Clearing the Non-Volatile RAM

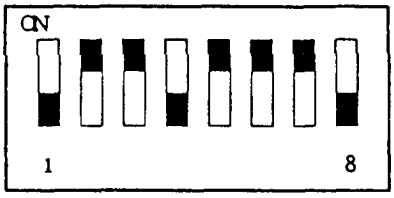
NOTE: Be sure to clear the non-volatile RAM after replacing the main board or before Starting any electrical adjustment.

(1) While holding down the control panel's △ POSITION key, turn on the plotter.

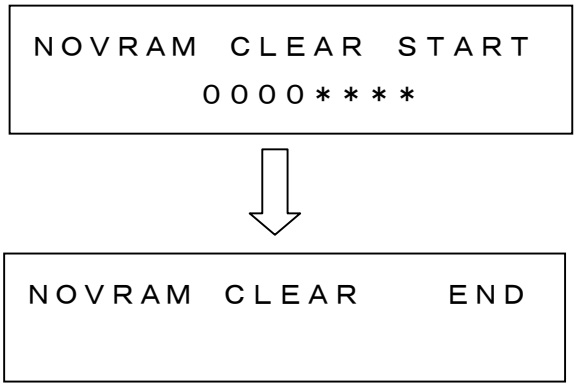
(2) After the following messages appear on the LCD panel, turn off the plotter.



(3) After setting the SW1 DIP switch as shown belw, turn on the plotter.



(4) The messages below consecutively appear on the LCD panel.



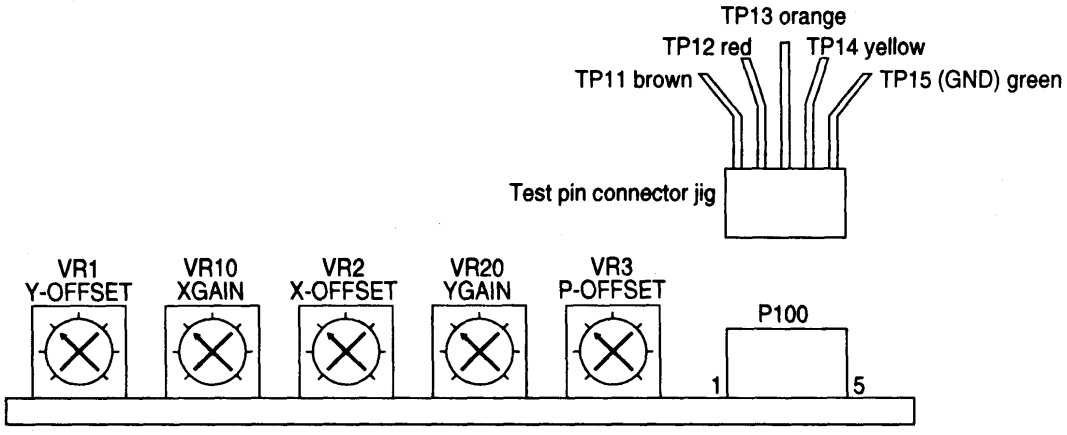
(5) After the "NOVRAM CLEAR END" message is displayed, return the DIP switch to its original settings and then turn off the plotter.

NOTE: Clearing the non-volatile RAM initializes the pen height adjustment, distance Accuracy adjustment, and other settings to their respective default values.

7.7 Default Trimmer Settings

Put the establishment of all the trimmers of the main board before doing an exchange together, and include a main new board into the plotter when you replace a main board.

Set it up as follows if you don't know the establishment of all the trimmers of the main board before doing an exchange.



VR1 (Y-OFFSET) : Trimmer for adjusting the Y motor offset
VR2 (X-OFFSET) : Trimmer for adjusting the X motor offset
VR3 (P-OFFSET) : Trimmer for adjusting the pen offset
VR10 (X-GAIN) : Trimmer for adjusting the X motor gain
VR20 (Y-GAIN) : Trimmer for adjusting the Y motor gain

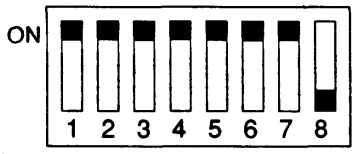
Brown : TP11
Red : TP12
Orange : TP13
Yellow : TP14
Green : TP15 (GND)

7.8 Adjusting the Motor Offset

NOTE: Before adjusting the motor driver IC's offset, disconnect the encoder lines of the X and Y motors from the main board's P22 and P32 connectors.

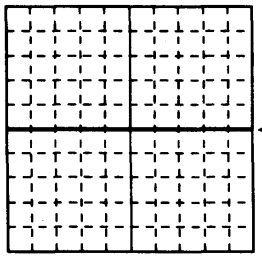
CAUTION: Be sure to adjust only one motor at a time. Before you begin, loosen and remove the X or Y synchro belt.

(1) Set the SW1 DIP switch as shown below and then turn on the plotter.
* Set only Bit 8 to OFF



SW1

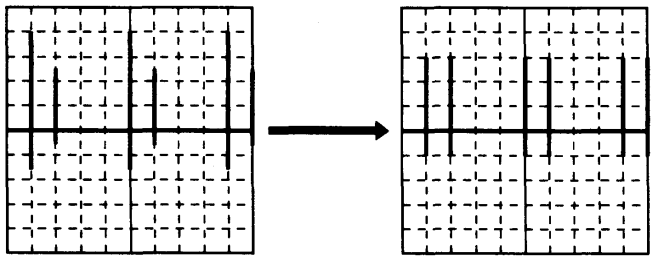
(2) Test pins TP11 to TP15 of the test pin connector jig correspond to Pins 1 to 5 of the P100 connector.



Vertical axis: 1 V/division
Horizontal axis: 5 µs/division

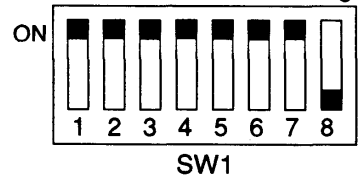
(3) Connect the probe of an oscilloscope to TP11 and connect either TP10 or TP15 to ground level. The waveform shown in Fig. 1 appears at the oscilloscope.

Fig. 1 Fig. 2



(4) Turn the VR2 (X-OFFSET) trimmer until the waveform peaks are the same height as shown in Fig. 2.
(5) To adjust the Y motor offset, repeat Steps (2) to (4) with the following changes.
Test pin: TP12 (connect TP10 or TP15 to ground level)
Trimmer: VR1 (Y-OFFSET)
(6) When adjustments are completed, return the DIP switch to its default settings and then turn off the plotter. Also reconnect the X and Y motor encoder lines and remount the X and Y synchro belts.

Default DIP switch settings



SW1

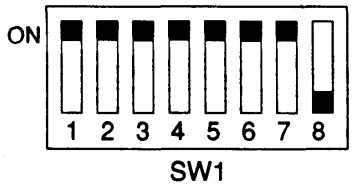
All bits are ON

A motor for adjustment purposes can be used instead of an oscilloscope to adjust the motor offset. Use a motor from a plotter or a cutting plotter.

NOTE: Before adjusting the motor driver IC's offset.
1. Disconnect all the X motor lines from the X joint board P301 and P302.
2. Disconnect all the Y motor lines from the X-Y joint board P601 and P602.

(1) Connect the motor to the connector of the axis you wish to adjust on the main board.
- X-AXIS : P301
- Y-AXIS : P601

(2) Set the DIP switch as shown below and then turn on the plotter.
(Set only Bit 8 to OFF)



SW1

(3) To adjust the X axis, adjust VR2 (X-OFFSET) until the motor stops rotating.

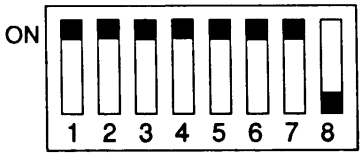
(4) To adjust the Y axis, adjust VR1 (Y-OFFSET) until the motor stops rotating.

(5) When the adjustments are completed, return the DIP switch to its default settings and then turn off the plotter. Also reconnect all the X and Y motor lines.

7.9 Adjusting the Pen Offset

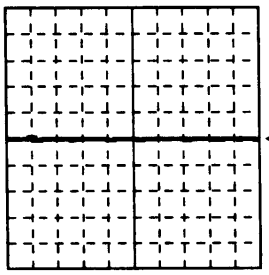
NOTE: Before adjusting the motor driver IC's offset, disconnect the encoder lines of the X and Y motors from the main board's P22 and P32 connectors.

(1) Set the SW1 DIP switch as shown below and then turn on the plotter.
* Set only Bit 8 to OFF



SW1

(2) Connect the probe of an oscilloscope to TP13 (Pin 3 of P100) and connect either TP10 or TP15 to ground level.



Vertical axis: 1 V/division
Horizontal axis: 2 µs/division

(3) The waveform shown in Fig. 1 appears at the oscilloscope.

Fig. 1

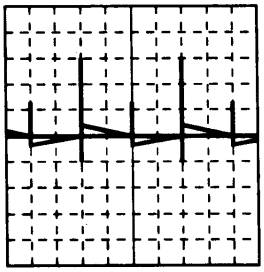
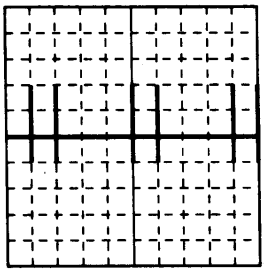


Fig. 2



(4) Turn the VR3 (P-OFFSET) trimmer until the waveform peaks are the same height as shown in Fig. 2.

(5) When adjustment is completed, return the DIP switch to its default settings and then turn off the plotter. Also reconnect the X and Y motor encoder lines.

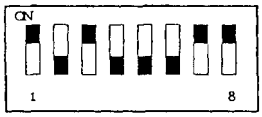
7.10 Adjusting the Pen Servo

CAUTION:
- Before starting automatic adjustment, make sure no pen or cutter is attached to the pen holder.
- To avoid malfunction of the pen holder, do not touch the pen holder during adjustment.
- Make sure that the pen holder is not in contact with the pen block cover.

(1) Set the SW1 DIP switch as shown below and then turn on the plotter.

1-pen models
Set Bits 4,5, and 6 to OFF

2-pen models
Set Bits 2,4,5, and 6 to OFF



(2) After the ROM and RAM checks, a menu for electrical adjustment appears on the LCD panel.

```
PEN HEIGHT
PEN FORCE    PARALLEL
```

(3) Press the [1] (PEN HEIGHT) key.

After the message below appears, the plotter initiates automatic offset and span adjustment of the pen height sensor.

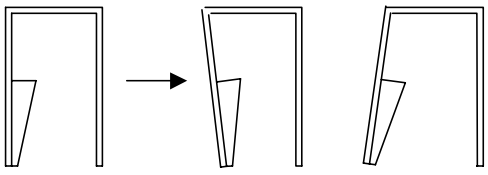
```
PEN HEIGHT
```

(4) In the case of a 2-pen model

Use a 2-channel oscilloscope to monitor the waveform of TP2 and TP3 on the Main Joint Board in the control box. Adjust trimmers VR7 and VR8 so that TP2 and TP3 have the same span and zero position when the pen 1 and pen 2 holders are simultaneously pressed down and then released. Do not mount any pens in the holders.

Use VR7 to adjust the levels at the up position, and VR8 to adjust the levels at the down position. Repeat the operations several times until the up and down levels are the same.

If you can not get the pen 1 waveform to match the pen 2 waveform, adjust the position of the pen 1 magnet by bending it slightly to one side so as to adjust its position relative to the Hall element sensor.



(5) When adjustment is completed, return the DIP switch to its default settings and turn off the plotter.

(6) Turn the plotter back on. Next, connect an oscilloscope or multimeter to the main board's TP14 pin (P100's Pin 4), and then manually hold down or release the pen holder while you check that the voltage levels conform to the table below.

When the pen holder is lowered	approx. +5 V
When the pen holder is raised	approx. -5 V

If the voltage levels are not approx. ±5 V, perform all of the following and then adjust the pen servo again.

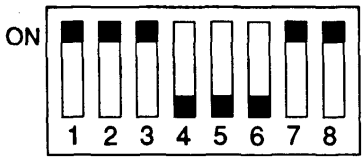
- Check the CAUTION remarks on the previous page.
- Check that the pen block is properly mounted
- Check that the pen height sensor is properly mounted
- Check the power unit's supply voltages
- Adjust the pen offset again

NOTE: Both of the pen holders are 2-pen models.

7.11 Adjusting the Pen Force

> **NOTE:** Are case of the 2-pen models adjustments are part of NO.2 pen holder and check of other side pen holder.

(1) Set the SW1 DIP switch as shown below and then turn on the plotter.
* Set Bits 4, 5, and 6 to OFF



SW1

(2) After the ROM and RAM checks, a menu for electrical adjustment appears on the LCD panel.

```
PEN HEIGHT
PEN FORCE      PARALLEL
```

(3) Attach a cutter plunger to the pen holder and then press the [2] (PEN FORCE) key. The message below appears.

```
FORCE  *g          PEN U/D
       ****
```

(4) When the [3] (PEN U/D) key is pressed, the cutter is lowered or raised. After lowering the cutter, use a dial tension gauge or its equivalent to measure the actual force of the displayed FORCE value. If the measured value does not match, use the △ or ▽ POSITION key to increase or lower the numeric value at the bottom left of the LCD panel.

> NOTE: After you have changed the numeric value on the LCD, press the F3 key PEN U/D to raise and lower the cutter before measuring the pen force again.

When the measured pen force is the specified value, press the [ENTER] key. The next specified pen force appears on the LCD panel.

Repeat the above procedure in the sequence.

	Standard pressure models	High pressure models
1	5g	10g
10	40g	80g
20	130g	260g
30	280g	560g
40	500g	1kg

(5) When adjustments are completed, return the DIP switch to its default settings and then turn off the plotter.

7.12 Adjusting the Main Servo Axes GAIN

(1) Connect the plotter and an IBM PC/AT or compatible computer using an RS-232C cable, then turn on the plotter.

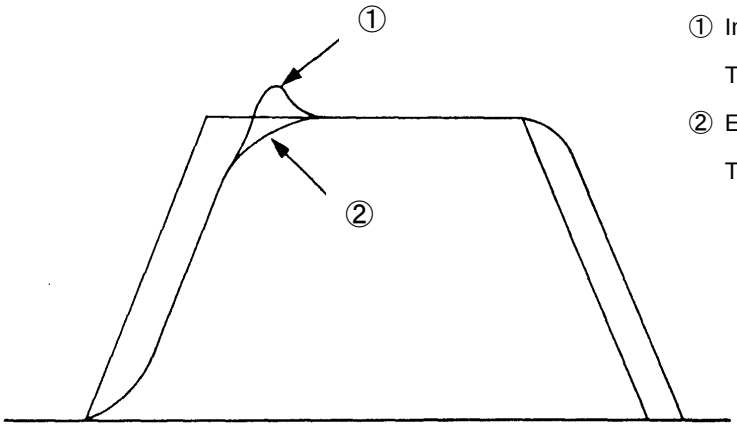
(2) Select CONDITION [1], then set each condition as follows:

7	COND	1	READY	0
30	PLOT		MODE	6

(3) Run the "FC2201" program.

(4) Press the [F3] → [F2] → [F1] → [F4] keys in that order to monitor the motor axis movement on the CRT display.

(5) While adjusting VR**10** and VR**20**, repeat the operation in step (5).



① Insufficient gain (overshoot)
Turn VR10 or VR20 to the right

② Excessive gain (undershoot)
Turn VR10 or VR20 to the left

X axis: Blue
Y axis: Red
Error: Green

X axis trimmer: VR**10** (X-GAIN)
Y axis trimmer: VR**2** (Y-GAIN)

(6) Using the above trimmers, perform adjustment so that the maximum error is 7 or less and XF and YF are positive.
If the overshoot value is large, turn the trimmer to the right; if it is small, turn the trimmer to the left.

(7) Repeat adjustment until the above-mentioned standard values are achieved.

7.13 Adjusting the Pen Interval (2 pen models)

This function only works on 2-pen models. It enables adjustment of the distance between the origins for Pen 1 and Pen 2.

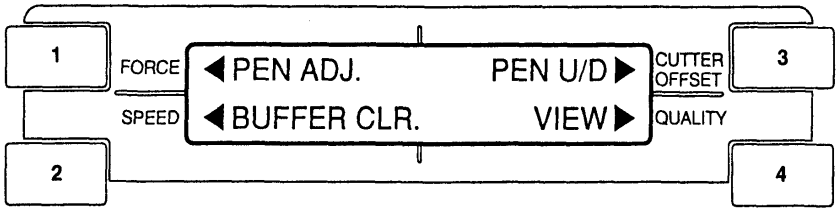
> **Note:** Pens are used to draw lines for this adjustment. As described below, mount pens in the Pen 1 and Pen 2 positions, then specify their conditions.

Procedure

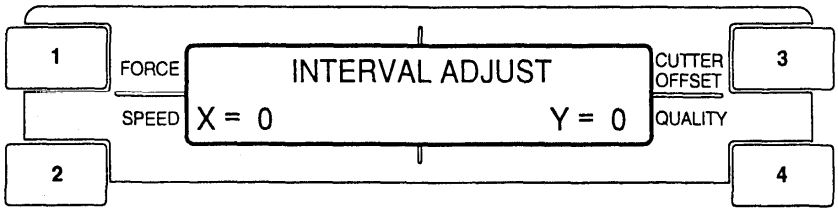
PAUSE : Press the PAUSE key to select PAUSE mode.

NEXT : Press the NEXT key.

The LCD panel displays the screen below.

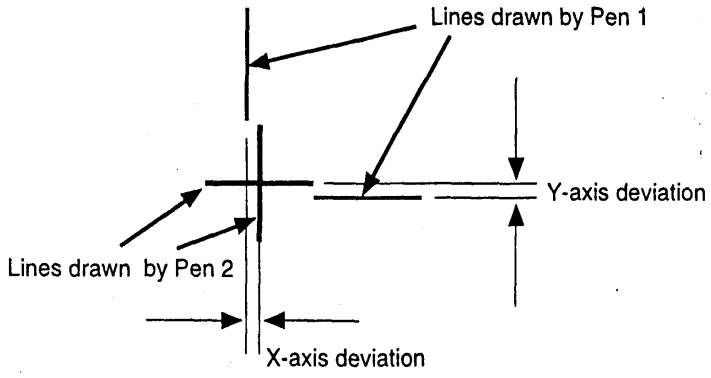


Press the 1 key (PEN ADJ.) to display the menu below.



Mount pens in the Pen 1 and Pen 2 positions.

TEST : When the TEST key is pressed, the lines shown below are drawn.



Adjust the deviation of Pen 1 based on the lines drawn by Pen 2.

[2] : To adjust the X-axis deviation, press the [2] key and then use the △ and ▽ keys to adjust the numeric value.

[4] : To adjust the Y-axis deviation, press the [4] key and then use the △ and ▽ keys to adjust the numeric value.

The X= and Y= values can be specified in a range of -80 to +80 in 1-unit steps.

The numeric value of 1 corresponds to 0.05 mm. To correct a deviation of 0.3 mm, for example, input 6.

[ENTER] : Press the [ENTER] key to register your INTERVAL ADJUST setting.

[PAUSE] : Press the [PAUSE] key to cancel PAUSE mode.

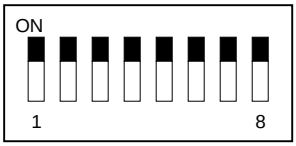
Note: Your INTERVAL ADJUST setting is retained in the plotter's internal memory even while the plotter is turned off.

7.14 DIP Switch Factory Settings

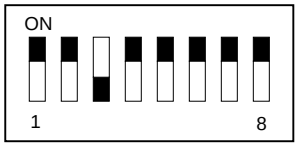
Settings for DIP Switch on the Main Board

1. FC2231-90/90EX/90T/90EXT, FC2232-90/90EX/90T/90EXT

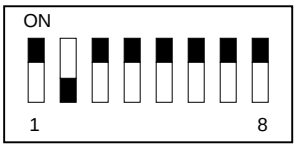
FC2231-90
Set Bits all ON



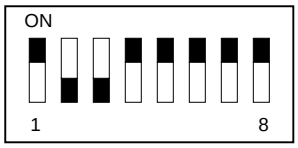
FC2231-90T
Set Bit 3 to OFF



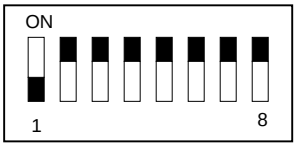
FC2232-90
Set Bit 2 to OFF



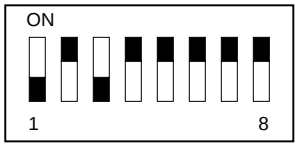
FC2232-90T
Set Bits 2 and 3 to OFF



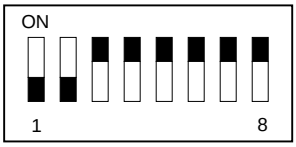
FC2231-90EX
Set Bit 1 to OFF



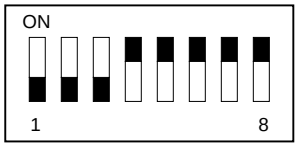
FC2231-90EXT
Set Bits 1 and 3 to OFF



FC2232-90EX
Set Bits 1 and 2 to OFF



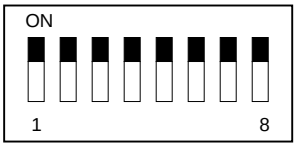
FC2232-90EXT
Set Bits 1, 2 and 3 to OFF



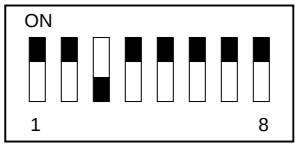
2. FC2231-60/60T, FC2232-60/60T

NOTE: ROM is different from -60/60T in the case of -90/90EX.

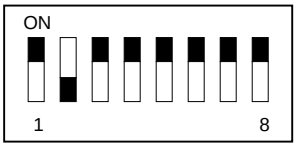
FC2231-60
Set Bits all ON



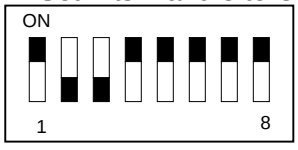
FC2231-60T
Set Bit 3 to OFF



FC2232-60
Set Bit 2 to OFF



FC2232-60
Set Bits 2 and 3 to OFF

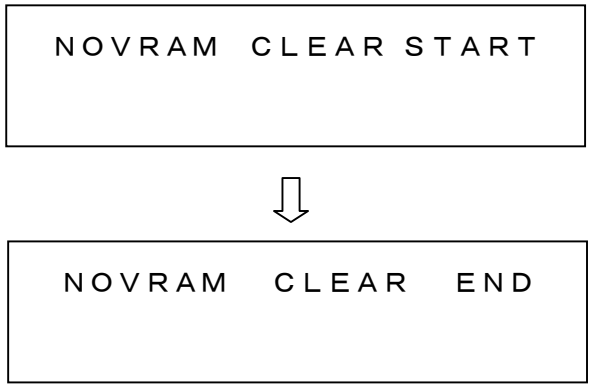


7.15 Factory Preset Settings

Perform the following procedure after completing all of the previous adjustments.

(1) While holding down the control panel's △ **POSITION** key, turn on the plotter.

(2) After the follwing messages appear on the LCD panel, turn off the plotter.



(3) After turning the plotter back on and waiting until it has been initialized, check that the plotter's conditions are set as follows.

1N or 2N Type

CONDITION1

```
12  COND1      PEN
20             READY
```

CONDITION2

```
14  COND2   09U   0
20            READY
```

CONDITION3

```
17  COND3   15U   0
20            READY
```

CONDITION4

```
25  COND4   15U   0
 5  READY         1
```

1T Type

CONDITION1

```
24  COND1      PEN
20             READY
```

CONDITION2

```
28  COND2   15U   0
10            READY
```

CONDITION3

```
34  COND3   15U   0
10            READY
```

CONDITION4

```
50  COND4   15U   0
 5  READY         1
```

1N+1T Type

CONDITION1

```
12  COND1      PEN
20             READY
```

CONDITION2

```
28  COND2   15U   0
10            READY
```

CONDITION3

```
34  COND3   15U   0
10            READY
```

CONDITION4

```
50  COND4   15U   0
 5  READY         1
```

(4) Setting the HP-GL command mode.

PAUSE : Press the PAUSE key to select PAUSE mode.

⇩

NEXT : Press the NEXT key.

⇩

NEXT : Press the NEXT key again.

⇩

```
I／F                FUNCTION
FILM                    2PEN
```

⇩

1 : Press the 1 key to select INTERFACE.

⇩

```
RS232C
STEPSIZE            COMMAND
```

⇩

4 : Press the 4 key to select COMMAND.

⇩

```
          COMMAND
  GP－GL            HP－GL
```

⇩

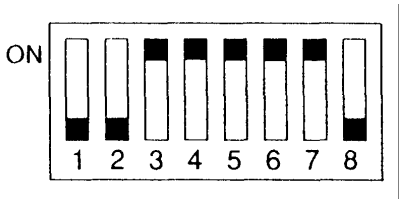
ENTER : Press the ENTER Key to register your setting.

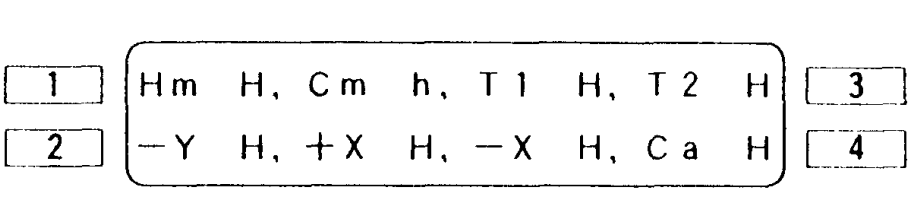
7.16 Using the Test Modes

7.16.1 Sensor Test Mode

(1) Set the SW1 DIP switch as shown below and then turn on the plotter.

Set only Bits 1,2, and 8 to OFF





(2) The status of each sensor is displayed on the LCD panel.

Display	Sensor name	Operation when the High/Low level chan s	
Hm	Y home sensor	When the dog blocks the sensor	L
-X	X home sensor	Same as the above	L

(3) If a sensor is not operating properly, check its wiring, its connector contact, and the position of the sensor dog. If everything checks out all right, either the sensor or main board may be defective.

In this case, initialize the NOV-RAM and then run the sensor test again.

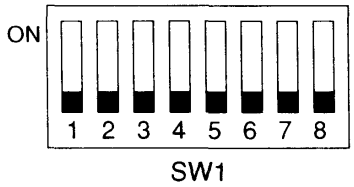
(4) As a temporary measure for dealing with a defective sensor, turn off the plotter, set Bit 4 of the DIP switch to OFF, and then turn the plotter back on.

CAUTION: When the plotter is turned back on, the pen position becomes the plot area's origin (0, 0) and the plotter is not initialized.
Unless the plot area is set, the cutting mat may be damaged and a position error may be caused by the pen block striking the side plate.

7.16.2 Keyboard Test Mode

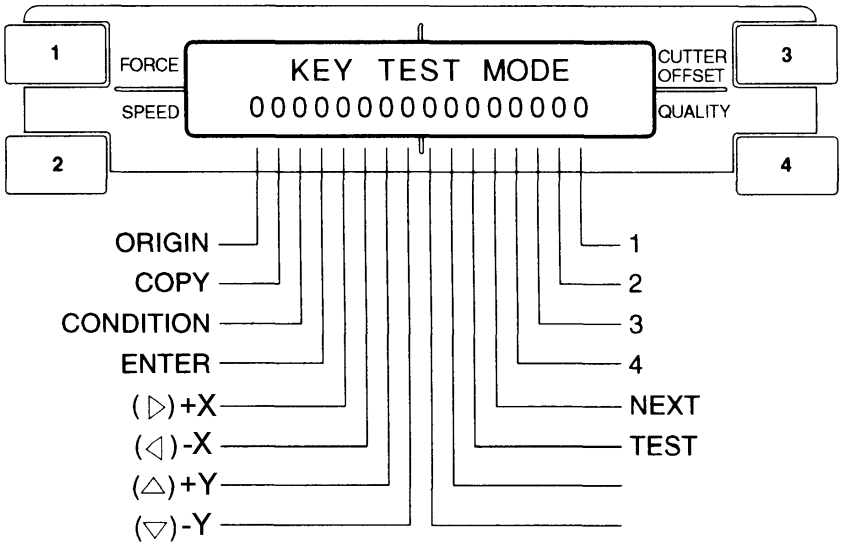
Run this test if a control panel key has malfunctioned.

(1) Set the SW1 DIP switch as shown below and then turn on the plotter.
* Set all bits to OFF



SW1

(2) The menu below appears, so press the panel key corresponding to each bit and check that its value properly changes to 1 or 0.



Normal status : 0
While the key is pressed : 1

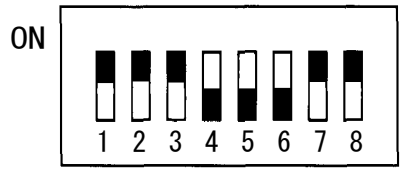
The [PAUSE] key can be checked by observing its lamp.

(3) if a panel key's corresponding bit does not properly change status, check the following and then run this test again.

- Fault in D1 or D2 on the PR223281 Key Joint Board; or the may be attached in reverse
- Improperly connected CA223211 cable
- Initialize the non-volatile RAM
- Defective main board

7.16.3 Setting the Parallel Interface

(1) Set the SW1 DIP switch as shown below and then turn on the plotter.
Set only Bits 4, 5 and 6 to OFF



(2) The prompt below appears.

```
PEN HEIGHT
PEN FORCE    PARALLEL
```

(3) Press the [4] (PARALLEL) key.

```
PARALLEL I/F
1
```

(4) Raise and lower the numerical value by using the △ or ▽ position key. Confirm your selection by pressing the [ENTER] key.

The numerical values 1 to 4 represent the modes shown below.

Mode 1: Data is received at the falling edge of the $\overline{\text{DSTB}}$ signal; $\overline{\text{ACK}}$ is not included in the $\overline{\text{BUSY}}$ signal.

Mode 2: Data is received at the falling edge of the $\overline{\text{DSTB}}$ signal; $\overline{\text{ACK}}$ is included in the $\overline{\text{BUSY}}$ signal.

Mode 3: Data is received at the rising edge of the $\overline{\text{DSTB}}$ signal; $\overline{\text{ACK}}$ is not included in the $\overline{\text{BUSY}}$ signal.

Mode 4: Data is received at the rising edge of the $\overline{\text{DSTB}}$ signal; $\overline{\text{ACK}}$ is included in the $\overline{\text{BUSY}}$ signal.

7.16.4 Belt running Test

Perform this test when you replace a belt.

(5) PAUSE : Press the PAUSE key to select PAUSE mode.
↓
NEXT : Press the NEXT key.
↓
NEXT : Press the NEXT key again.
↓
NEXT : Press the NEXT key again.
↓
4 : Press the 4 key to select OPTION2.
↓
4 : Press the 4 key to select TEST.

The prompt message below appears.

```
                SELF  TEST>
<CONDITION          DUMP>
```

(6) Press the 1 key and then the ENTER key. The prompt message below appears.

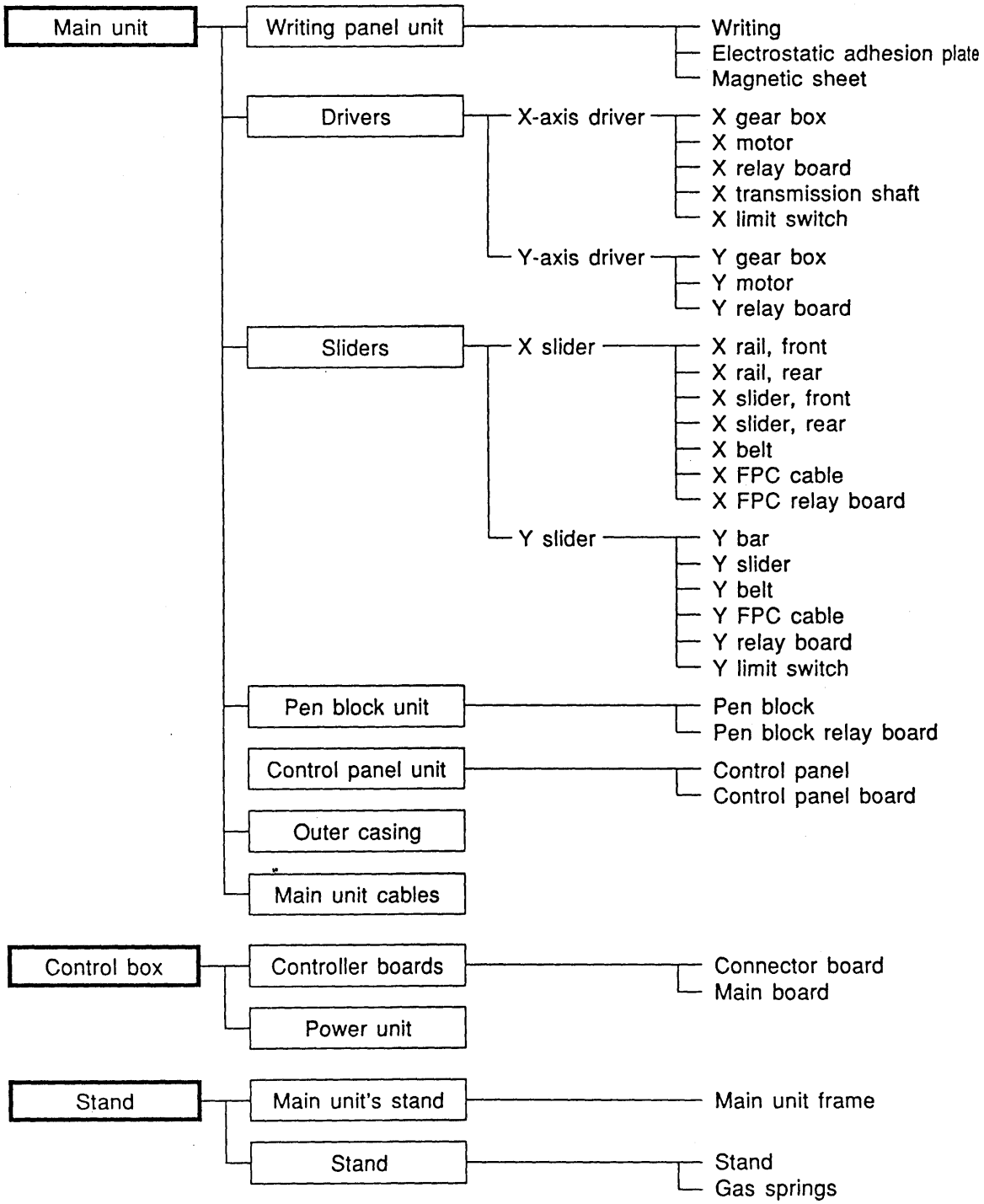
```
<MECHA        ISO  PATTERN>
<AGING                BELT>
```

(7) Press the 4 key to select BELT and to start the belt running test. When you have finished the running test, turn off the plotter to stop the test.

8. CONFIGURATION, MAINTENANCE PARTS, and MAINTENANCE TOOLS

8.1 Configuration

The Series can be broadly divided into three blocks, which are each further subdivided as shown below.



8.2 Maintenance Parts

8.2.1 Mechanical Maintenance Parts

No.	Part Name	Required Adjustments
1	Electrostatic adhesion plate	
2	X gear box assembly	Belt tension adjustment, alignment adjustment
3	X motor assembly	Belt tension adjustment, servo adjustment
4	X synchro belt	Belt tension adjustment, alignment adjustment
5	Y motor assembly	Belt tension adjustment, servo adjustment
6	Y gear box assembly	Belt tension adjustment, alignment adjustment
7	Y synchro belt	Belt tension adjustment
8	X slider F assembly	Y bar height adjustment, perpendicularity adjustment, clearance adjustment
9	X slider R assembly	Belt tension adjustment
10	X belt	Belt tension adjustment
11	X FPC cable	
12	Y bar assembly	Height adjustment, perpendicularity adjustment, Y belt tension adjustment, clearance adjusment, servo adjustment
13	Pen block assembly	Pen block height adjustment, pen servo adjustment

8.2.2 Board-Related Maintenance Parts

No.	Part Name	Required Adjustments
1	X limit switch board assembly	Clearance adjustment
2	Y limit switch board assembly	Clearance adjustment
3	Control panel board assembly	
4	Connector board assembly	
5	Main board assembly	Servo adjustment, pen servo adjustment

8.3 Tools Required for Maintenance Work

(1) Screwdrivers

Phillips screwdriver	For M5, M4, and M3 screws (general-purpose screws)
Phillips screwdriver	For M2 screws
Blade screwdriver	For adjusting the variable resistors on the board

(2) Hexagon wrench

1.5 mm span	For M3 setscrews
2.0 mm span	For M4 setscrews
2.5 mm span	For the pen block setscrews

(3) Box wrench

5.5 mm span	For removing M3 nuts

(4) Adhesive

Bond-type adhesive	For securing screws
Double-sided tape (10 mm wide)	For securing the FPC cables

(5) Cleaning solution

Ethyl alcohol	For cleaning the electrostatic adhesion plate and rail

(6) Measuring tools

Metallic ruler (about 15 cm long)	For adjusting belt tension and simple checking of dimensions
Multimeter	For checking damaged or shorted wires

(7) Adjustment tools

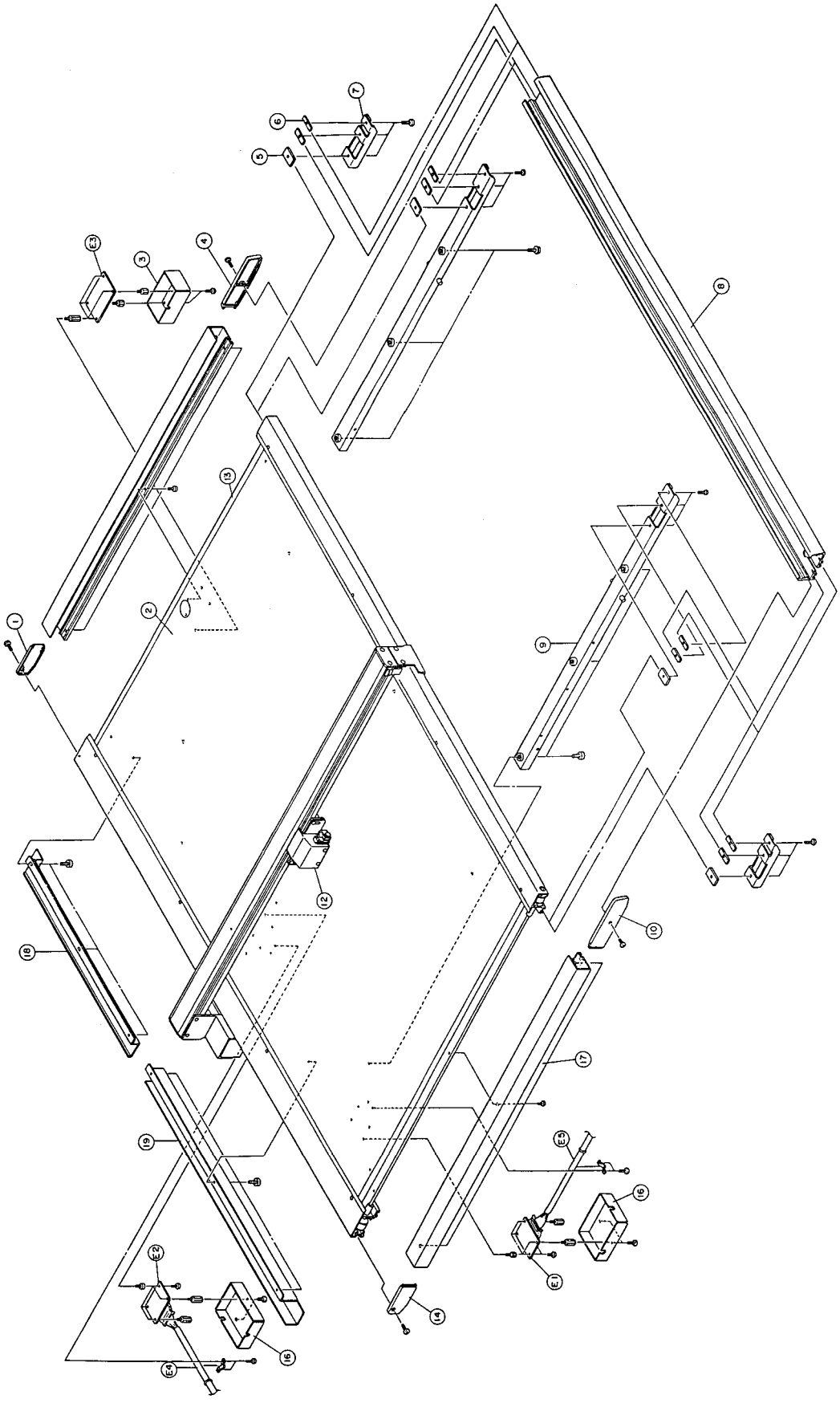
Digital voltmeter	For main board adjustments
Oscilloscope	
Test pin connector jig	

9. Disassembly Diagrams And Parts Lists

9.1 Mainframe (1-Pen Type)

No.	Part No.	Description	Q'ty	Remarks	
E1	772232120	X Joint Board	1	PR223203 Assembly	
E2	772232100	X Flex. Board	1	PR223224 Assembly	
E3	773503490	High Voltage Board	1	PR31001C Assembly	
E4	122927320 692807300	Y Cable	1	CA2292-32 (-60/-90) CA2232-32 (-EX)	
E5	122907030	X Cable	1	CA2290-03	
1	022900072	Corner Cover (Rear Right)	1		
2	022900081 022900201 022900130 022900140	Electrostatic Panel 12 Electrostatic Panel Magnetic Sheet 90 Magnetic Sheet EX	1	FC2200-90/ES FC2200-90EX/ES FC2200-90MG FC2200-90EX/MG	
3	022907302	Power Board Cover	1		
4	022900051	Corner Cover (Front Right)	1		
5	022907391	Support Bracket	4	M4-18	
6	022907291	Support Bracket	8	M4-12	
7	022907231	Frame Holder Plate	2		
8	022900740 022900750	Tray 12 Tray	1	FC2200-90 FC2200-90EX	
9	022907410	Main Frame	2		
10	022900041	Corner Cover (Front Left)	1		
12	792201150	1 Pen Type Block Assembly	1	Standard cutting pressure	
12	792291702	1 Pen T Type Block Assembly	1	High cutting pressure	
13	022900013 022900103	Writing Panel 12 Writing Panel	1	FC2200-90 FC2200-90EX	
14	022900062	Corner Cover (Rear Left)	1		
16	022907253	Board Cover	2		
17	022900031	Side Cover	2		
18	022903751 022903721	Flexible Guide 12, Right Flexible Guide, Right	1	FC2200-90 FC2200-90EX	
19	022903721 022903781	Flexible Guide 12, Left Flexible Guide, Left	1	FC2200-90 FC2200-90EX	

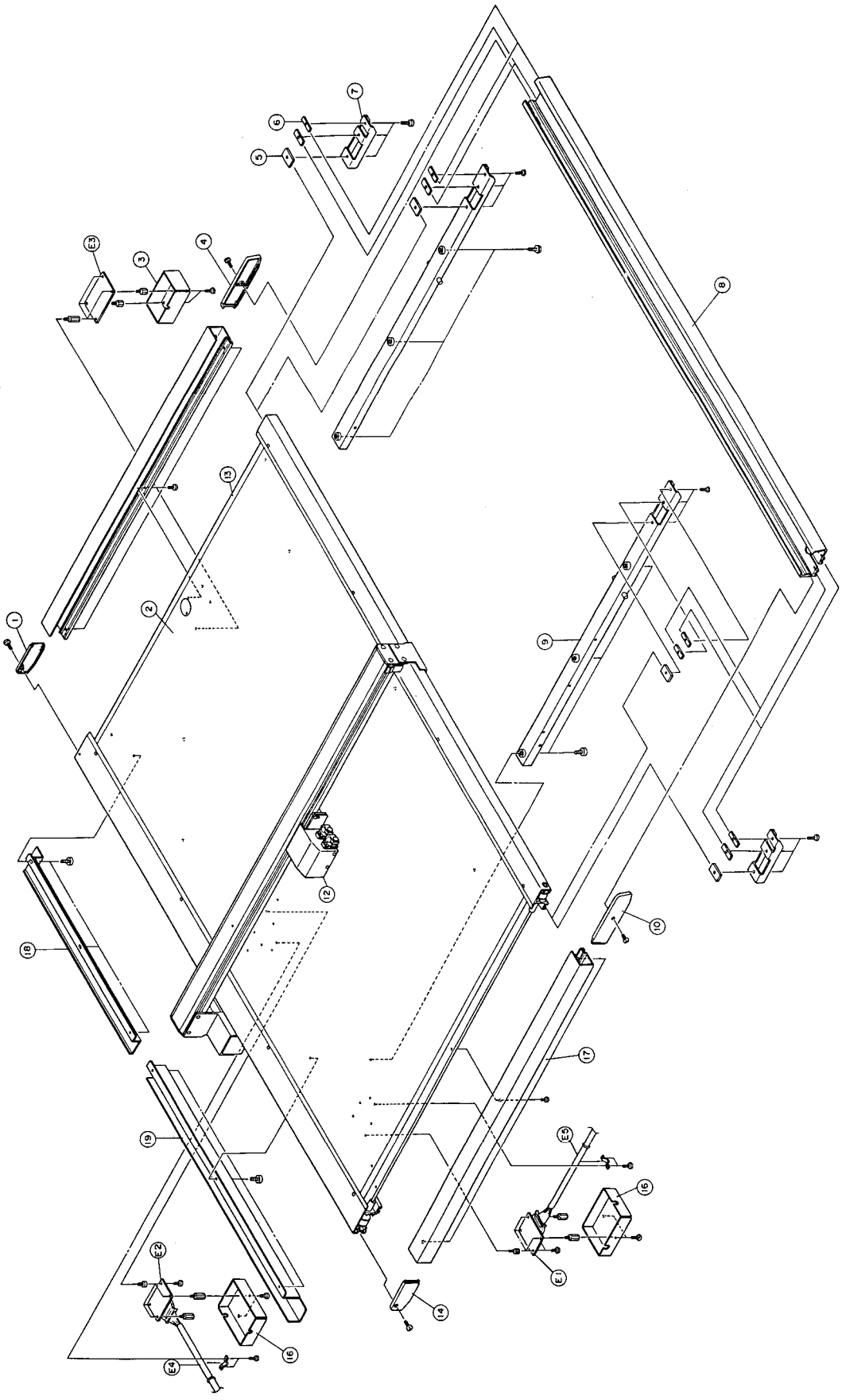
Mainframe (1-PEN TYPE)



9.2 Mainframe (2-Pen Type)

No.	Part No.	Description	Q'ty	Remarks	
E1	772232120	X Joint Board	1	PR223203 Assembly	
E2	772232100	X Flex. Board	1	PR223224 Assembly	
E3	773503490	High Voltage Board	1	PR31001C Assembly	
E4	122927320 692807300	Y Cable	1	CA2292-32 (-60/-90) CA2232-32 (-EX)	
E5	122907030	X Cable	1	CA2290-03	
1	022900072	Corner Cover (Rear Right)	1		
2	022900081 022900201 022900130 022900140	Electrostatic Panel 12 Electrostatic Panel Magnetic Sheet 90 Magnetic Sheet EX	1	FC2200-90/ES FC2200-90EX/ES FC2200-90MG FC2200-90EX/MG	
3	022907302	Power Board Cover	1		
4	022900051	Corner Cover (Front Right)	1		
5	022907391	Support Bracket	4	M4-18	
6	022907291	Support Bracket	8	M4-12	
7	022907231	Frame Holder Plate	2		
8	022900740 022900750	Tray 12 Tray	1	FC2200-90 FC2200-90EX	
9	022907410	Main Frame			
10	022900041	Corner Cover (Front Left)	1		
12	792232700	2 Pen Type Block Assembly	1	Standard cutting pressure	
12	792232701	2 Pen T Type Block Assembly	1	High cutting pressure	
13	022900013 022900103	Writing Panel 12 Writing Panel	1	FC2200-90 FC2200-90EX	
14	022900062	Corner Cover (Rear Left)	1		
16	022907253	Board Cover	2		
17	022900031	Side Cover	2		
18	022903751 022903721	Flexible Guide 12, Right Flexible Guide , Right	1	FC2200-90 FC2200-90EX	
19	022903721 022903781	Flexible Guide 12, Left Flexible Guide , Left	1	FC2200-90 FC2200-90EX	

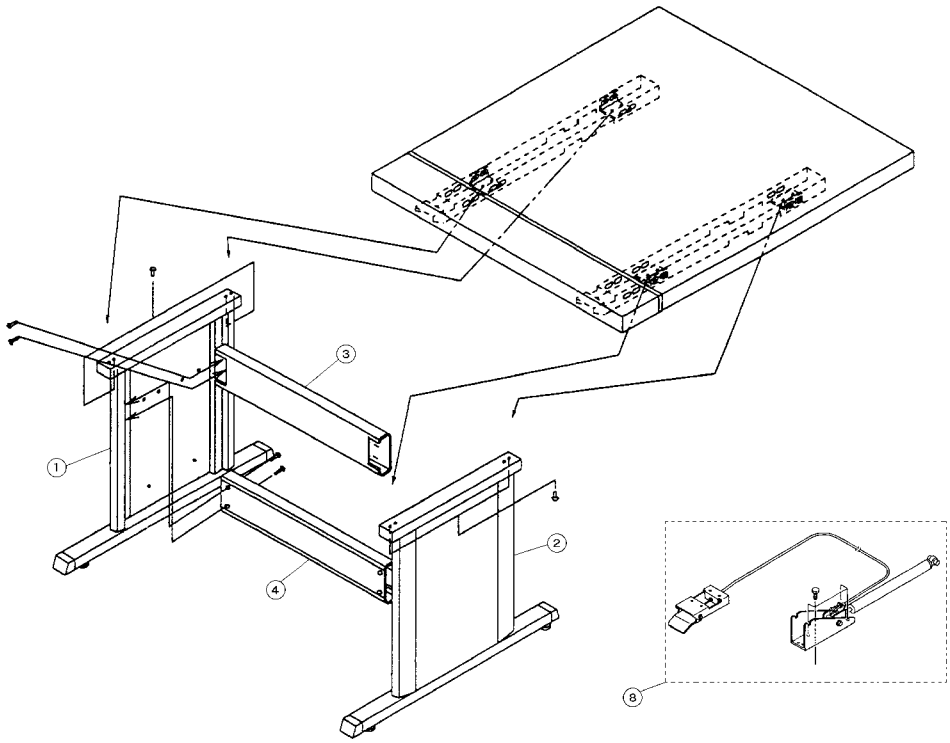
Mainframe (2-PEN TYPE)



9.3 Stand Section

No.	Part No.	Description	Q'ty	Remarks	
1	622301770 622301701	Side Foot L-60 Side Foot L-90/EX	1	FC2230-60 FC2230-90/EX	
2	622301690 622301711	Side Foot R-60 Side Foot R F223	1	FC2230-60 FC2230-90/EX	
3	054221031 622301800	Main Bar R-2 Main Bar R-90	1	FC2230-60 FC2230-90/EX	
4	054221021 622301790	Main Bar F-2 Main Bar F-90	1	FC2230-60 FC2230-90/EX	
8	772290670	Gas Spring Assembly	1		
	772230820	Stand 60	1		
	772230490	Stand 90	1		
	772230500	Stand 90EX	1		

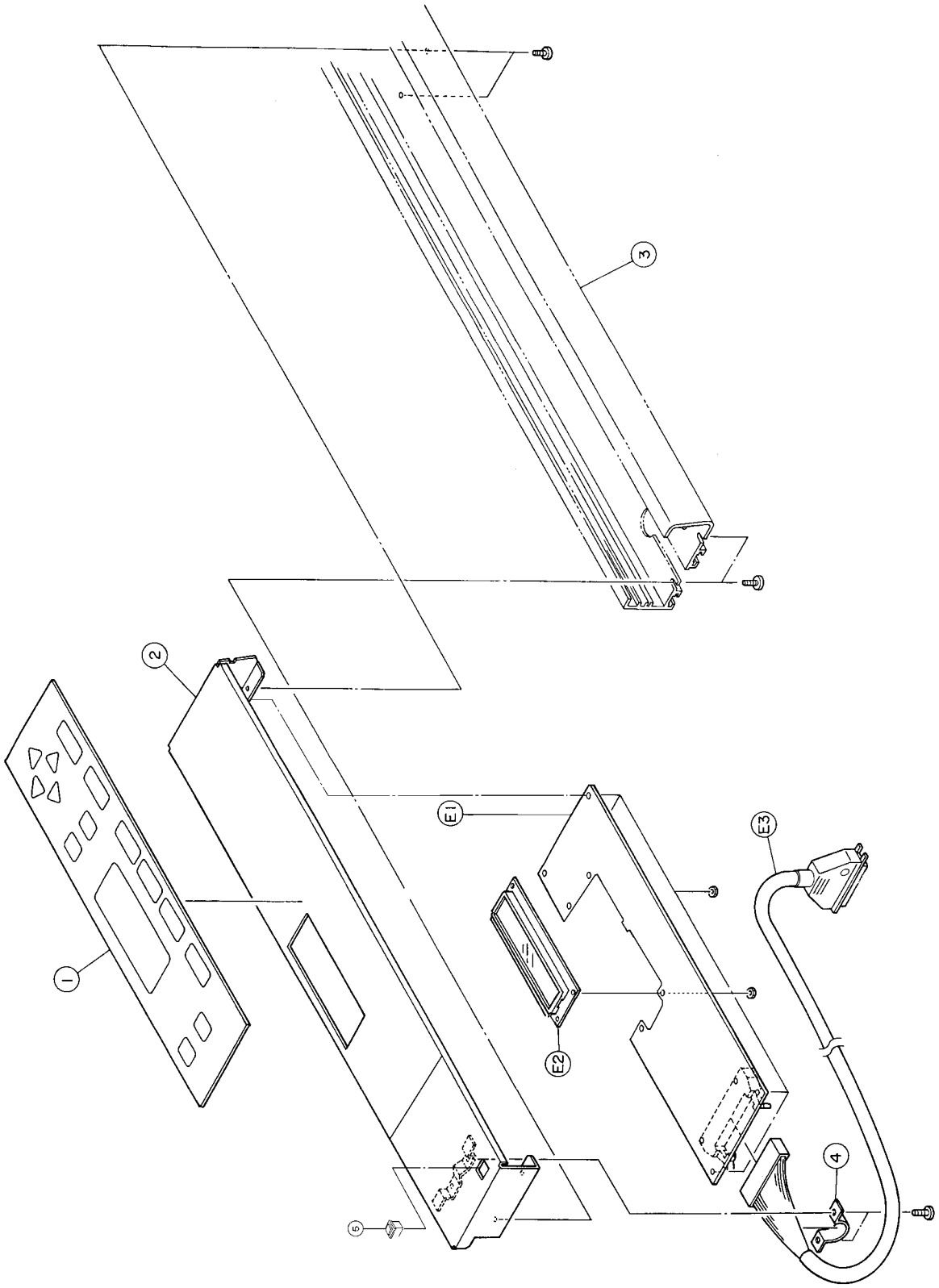
Stand Section



9.4 Control Panel Unit

No.	Part No.	Description	Q'ty	Remarks	
E1	772232010	Key Joint Board	1	PR223281	
E2	772232020	LCD	1		
E3	122907010	Control Cable		CA2290-01	
1	121606111	Sheet Switch	1	FPC216011	
2	622300110	Panel Frame	1		
3	022900742 022900750	Tray 12 Tray		FC2200-90 FC2200-90/EX	
4	022900572	Cable Holder	1		
5	772230260	Chart Hold Switch	1		

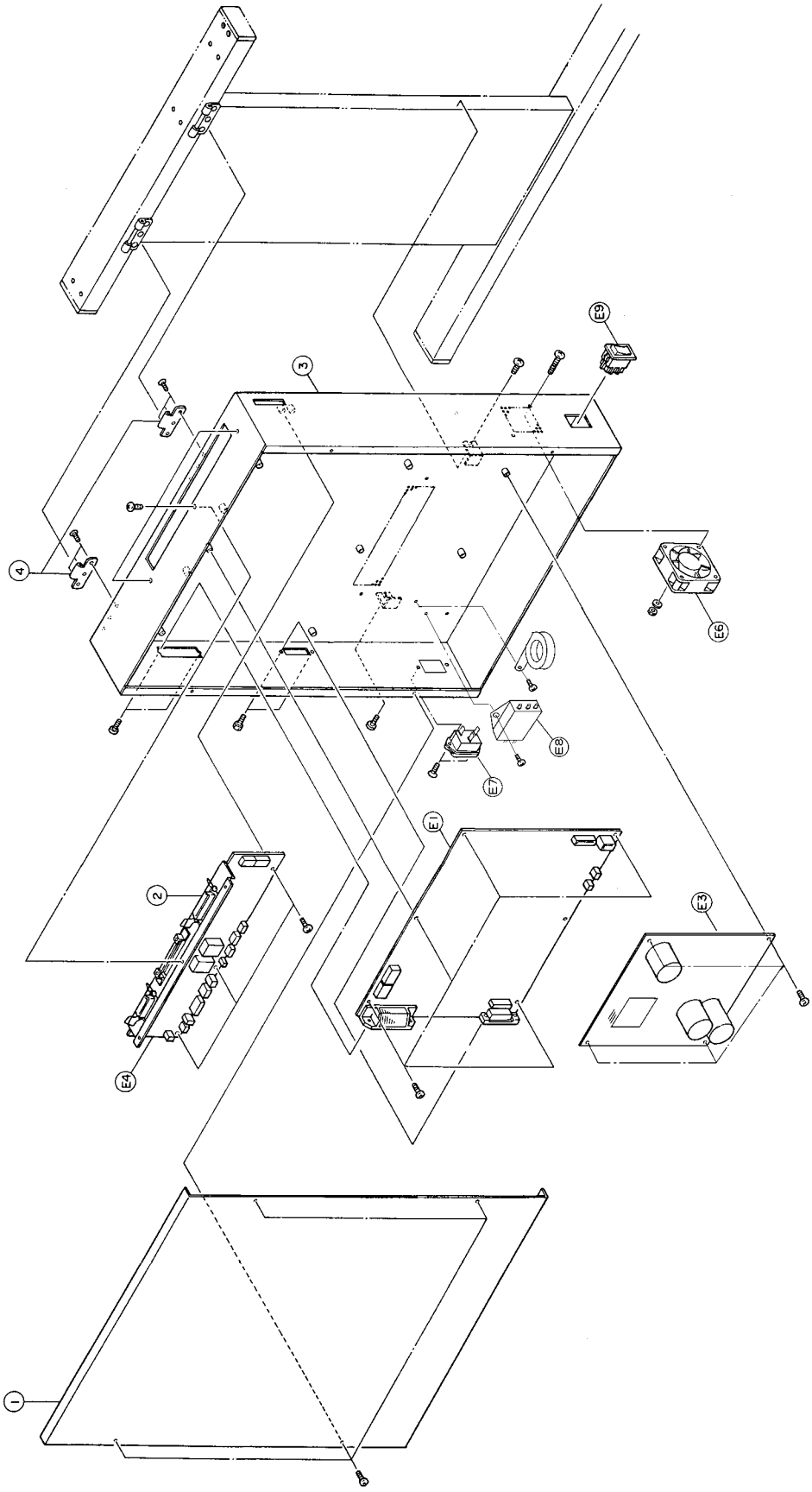
Control Panel Unit



9.5 Control Unit

No.	Part No.	Description	Q'ty	Remarks	
E1	792233700	Main Board	1	FC2230 series	
E3	510000051	Switching Power Supply	1	PS089	
E4	772232530	Main Joint Board	1	PR223282	
E6	500050273	Fan Motor	1	TUDC24B4	
E7	500050271	AC Inlet	1	NC174-10N-C-F635	
E8	792233701	Noise Filter	1		
E9	508102306	Power Switch	1	SW,2WI36/92	
1	622300020	Upper Chassis	1		
2	022907180	Connector Plate	1		
3	622300120	Chassis	1		
4	302200019	Plate	2		

Control Unit

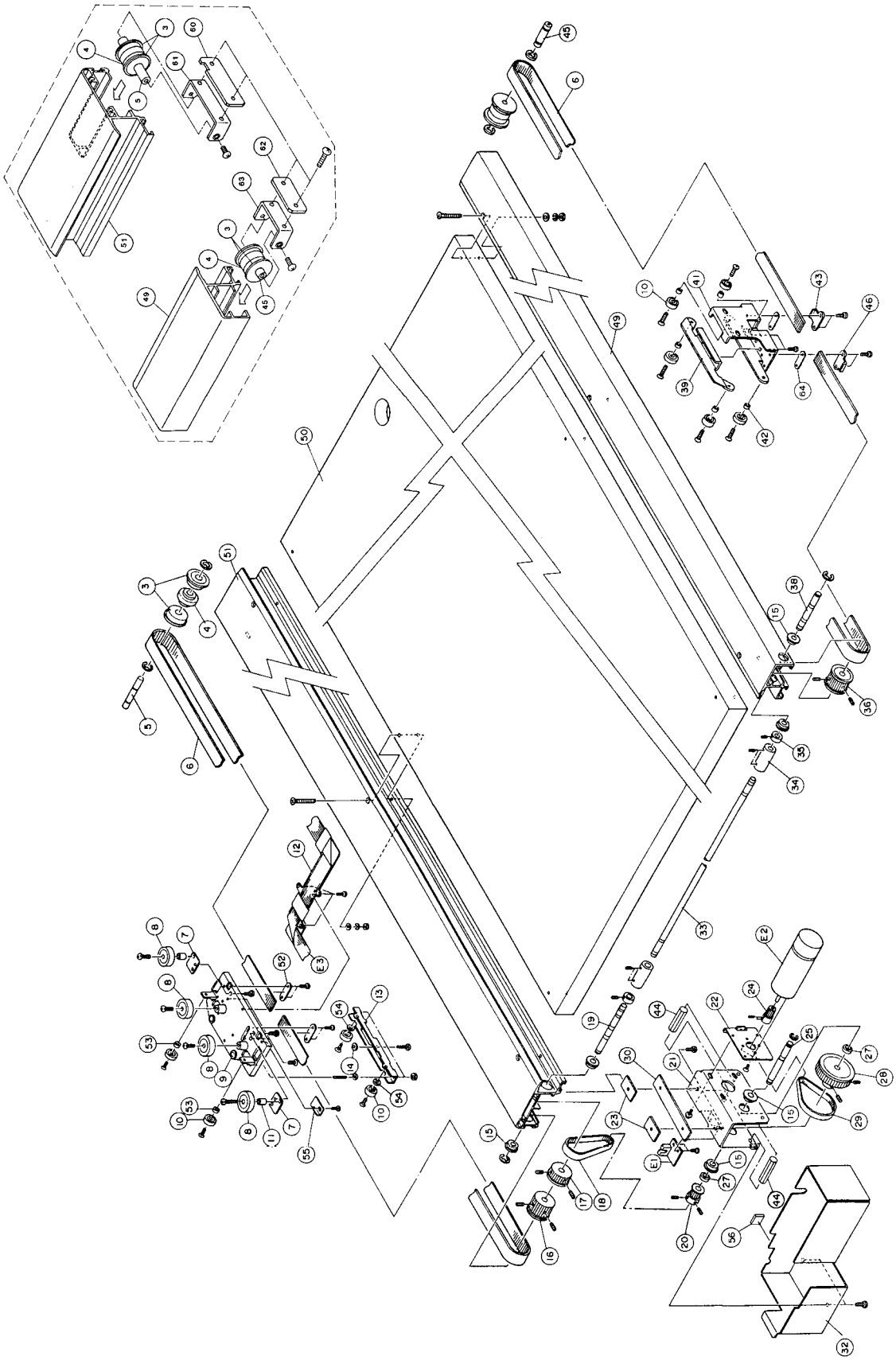


9.6 X Drive Unit (1/2)

No.	Part No.	Description	Q'ty	Remarks	
3	312208069	Bearing	4	F608ZZ	
4	022904221	Bearing Spacer	2		
5	022903590	Pulley Shaft, Right	2		
6	022904510 022904520	X Belt X Belt EX	2	S2ML3200 FC2200-90 S2ML4200 FC2200-90EX	
7	022903671	Roller Lever	2		
8	022900400	Roller ϕ27	3		
9	022903533	X Slider	1		
10	020003131	Roller	9		
11	022903680	Roller Collar A	2		
12	022903662	Flexible Plate	1		
13	022903871	Lower Bracket, Right	1		
14	022903911	X Roller Collar	1		
15	311608034	Bearing	6	F688ZZ	
16	022902540	Drive Pulley R	1	S2M	
17	022903260	Pulley	1	60Z-TN	
18	372290003	Notched Synchro Belt	1	120TN15-15W	
19	022903181	Drive Shaft, Rear	1		
20	022903151	Pulley	1	30Z-TN	
21	022903102	Gear Box	1		
22	022903111	X-Motor Bracket	1		
23	022903121	Box Fitting Plate	2		
24	053206100	Motor Pulley	1	Z22	
25	022903133	Intermediate Shaft	1		
27	022900360	Drive Collar C	1		
28	022903250	Pulley	1	99Z-TN	
29	375311001	Notched Synchro Belt	1	120TN15	
30	022900351	X Gear Space Board	1		
32	022903222	X Motor Cover	1		
33	022903242	Drive Shaft M	1		
34	022903290	Coupling	2		
35	022903211	Collar	2		
36	022902530	Drive Pulley F	1	S2M	
38	022903191	Drive Shaft, Front	1		
39	022903851	Lower Bracket, Front	1		
41	022903521	X Slider, Front	1		
42	022903910	X Roller Collar	5		
43	022903651	Belt Plate D	1		
44	302200026	Shaft	1	ASB335	
45	022903580	Pulley Shaft, Front	1		
46	022903641	Belt Plate C	1		
49	022903500 022903761	X Rail, Front 12 X Rail, Front	1	FC2200-90 FC2200-90/EX	

No.	Part No.	Description	Q'ty	Remarks	
50	022900013 022900103	Writing Panel 12 Writing Panel	1	FC2200-90 FC2200-90/EX	
51	022903511 022903772	X Rail, Rear 12 X Rail, Rear	1	FC2200-90 FC2200-90/EX	
52	022903631	Belt Plate B	2		
53	022903691	Roller Collar B	2		
54	022904212	Spacer ϕ 04-1.5	2		
55	022903612	Sensor Dog	1		
56	362200005	Rubber Foot	1	SJ5008	
E1	772230250	X Limit Switch	1	PR223208	
E2	509000004	X Motor	1	UGFMEDA5LGR27	
E3	162291230 162291240	X Flexible Cable X Flexible Cable	1	FC2200-90 FC2200-90/EX	
60	022904540	XR End	1		
61	022904560	XR Pulley Bracket	1		
62	022904530	XF End	1		
63	022904550	XF Pulley Bracket	1		
64	622301630	Belt Plate	2		

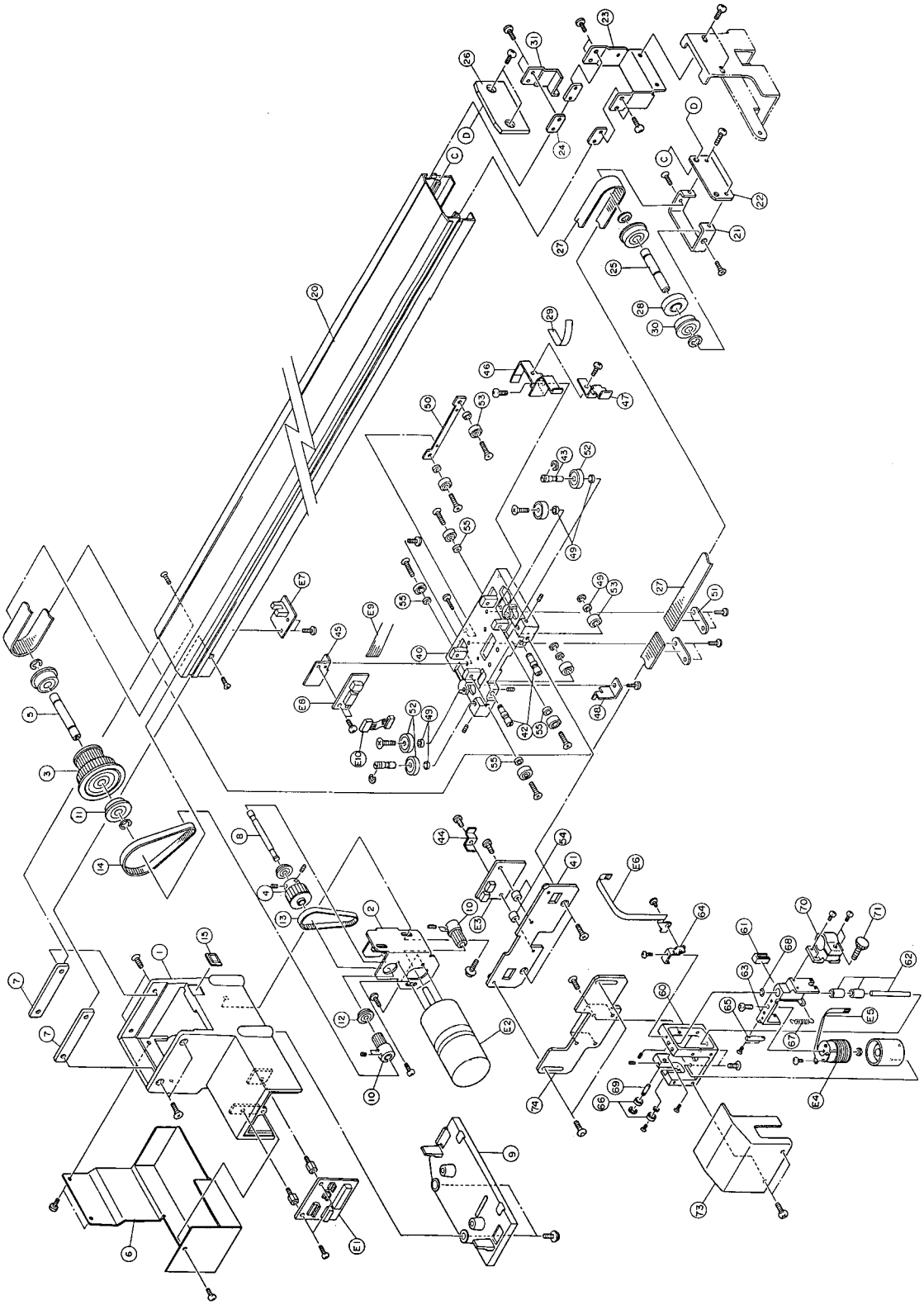
X Drive Unit



No.	Part No.	Description	Q'ty	Remarks	
1	022903301	Y Gear Box	1		
2	022903311	Motor Bracket	1		
3	022903362	Pulley	1	88Z-TN	
4	022903370	Pulley	1	44Z-TN	
5	022903331	Y Pulley Shaft	1		
6	022903342	Box Cover	1		
7	022903351	Y Bar Plate	2		
8	022903380	Shaft ϕ5	1		
9	022903534	X Slider R	1		
10	053206100	Motor Pulley	2	22Z	
11	311608034	Bearing	2	F688ZZ	
12	315211089	Bearing	2	F605ZZ	
13	379011002	Notched Synchro Belt	1	79TN15-10.0K	
14	375311001	Notched Synchro Belt	1	120TN15-10.0W	
15	362200005	Rubber Foot	1	SJ-5008	
20	022904012	Y Bar	1		
21	022904041	Y Pulley Bracket	1		
22	022904230	Y F End	1		
23	022904062	Y Front Bracket	1		
24	022904071	Y Front Plate	3		
25	022904080	Bearing Shaft	1		
26	022904092	Y End Front Cover	1		
27	022904500	Y Belt	1	S2ML2350	
28	022904221	Bearing Spacer	1		
29	022904331	Flexible Guard	1		
30	312208069	Bearing	2	F608ZZ	
31	022904250	Y Stopper	1		
		(Y Slider Unit)			
40	022904022	Y Slider	1		
41	022904122	Plate	1		
42	022904131	Offset Pin A	2		
43	022904151	Offset Pin C	2		
44	022904311	GND Plate	1		
45	022904171	Board Bracket	1		
46	022904182	Flexible Guard	1		
47	022904192	Flexible Plate	1		
48	022904202	Y Sensor Holder	1		
49	022904212	Collar ϕ4-1.5	6		
50	022904300	Roller Plate	1		
51	022903631	Belt Holder B	2		
52	020003131	Roller	4		
53	022900410	Roller ϕ12	8		
54	359200007	Spacer	2	C305	
55	022904321	Y Roller Collar	4		

No.	Part No.	Description	Q'ty	Remarks	
		(Pen Block Unit)			
				Standard Pressure Type	
60	022902401	MC Block	1	22AL	
61	090113200	Long Magnetic Circuit Board A	1	A0000	
62	010014101	Slide Shaft Assembly	1		
63	021500621	50 Slide Arm	1		
64	022906323	Hall IC Bracket	1		
65	053203390	Guide Shaft	1		
66	310069220	Bearing	2	BB692ZZMC39S2S	
67	053203350	MC Up Spring	1		
68	340804012	O Ring,S4	1		
69	034004591	Offset Pin	1		
70	021500630	Cutter Holder	1		
71	302200029	Pen Mounting Screw M4 × L15	1		
73	022902421	Pen Cover	1		
74	022902412	Block Plate	1		
80	792201150	1 Pen Type Block Assembly	1	Standard Cutting Pressure	
81	792291702	1 Pen T Type Block Assembly	1	High Cutting Pressure	
E1	772232110	X-Y Joint Board	1	PR223225 Assembly	
E2	509410107	Y Motor	1	UGFMED A5TGR33 Y	
E3	772231350	1 Pen Board	1	PR223107 Assembly	
E4	305320007	Moving Coil	1	PL-326B	
E5	110006060	Flexible Printed Circuit	1	FPC10002	
E6	792150709	Height Sensor	1		
E7	772230310	Y Limit Switch Assembly	1	PR223208 Assembly	
E8	772232130	Pen Flex. Board	1	PR223226 Assembly	
E9	162291100	Y Flexible Cable	1	FCASS91010	
E10	122907040	Cable	1	CA2290-04	

Y Drive Section (1-PEN TYPE)

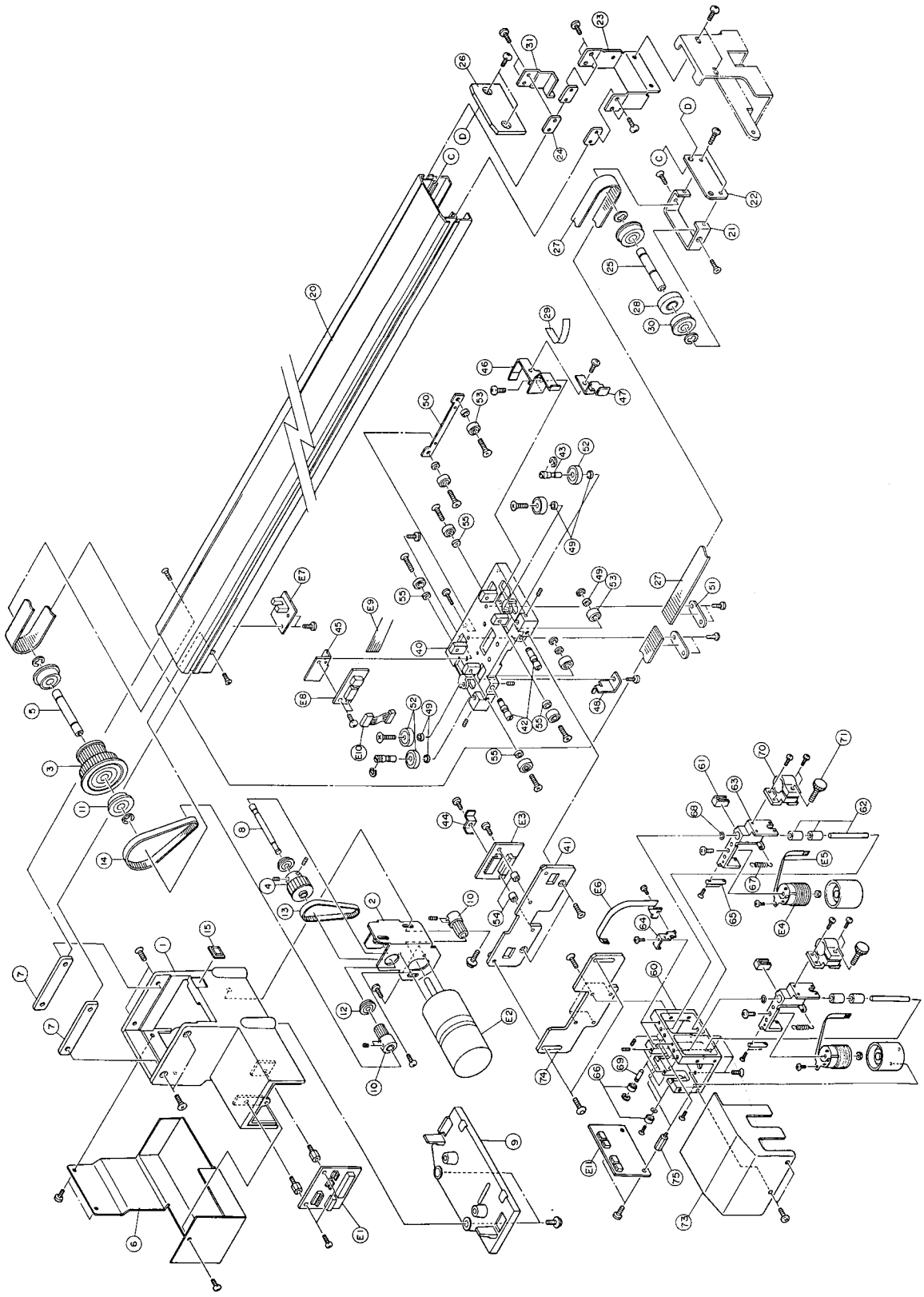


9.8 Y Drive Section (2-Pen Type) (1/2)

No.	Part No.	Description	Q'ty	Remarks	
1	022903301	Y Gear Box	1		
2	022903311	Motor Bracket	1		
3	022903362	Pulley	1	88Z-TN	
4	022903370	Pulley	1	44Z-TN	
5	022903331	Y Pulley Shaft	1		
6	022903342	Box Cover	1		
7	022903351	Y Bar Plate	2		
8	022903380	Shaft ϕ5	1		
9	022903534	X Slider R	1		
10	053206100	Motor Pulley	2	22Z	
11	311608034	Bearing	2	F688ZZ	
12	315211089	Bearing	2	F605ZZ	
13	379011002	Notched Synchro Belt	1	79TN15-10.0K	
14	375311001	Notched Synchro Belt	1	120TN15-10.0W	
15	362200005	Rubber Foot	1	SJ-5008	
20	022904012	Y Bar	1		
21	022904041	Y Pulley Bracket	1		
22	022904230	Y F End	1		
23	022904062	Y Front Bracket	1		
24	022904071	Y Front Plate	3		
25	022904080	Bearing Shaft	1		
26	022904092	Y End Front Cover	1		
27	022904111	Y T2 Belt	1	S2ML2350	
28	022904221	Bearing Spacer	1		
29	022904331	Flexible Guard	1		
30	312208069	Bearing	2	F608ZZ	
31	022904250	Y Stopper	1		
		(Y Slider Unit)			
40	022904022	Y Slider	1		
41	022904122	Plate	1		
42	022904131	Offset Pin A	2		
43	022904151	Offset Pin C	2		
44	022904311	GND Plate	1		
45	022904171	Board Bracket	1		
46	022904182	Flexible Guard	1		
47	022904192	Flexible Plate	1		
48	022904202	Y Sensor Holder	1		
49	022904212	Collar ϕ4-1.5	6		
50	022904300	Roller Plate	1		
51	022903631	Belt Holder B	2		
52	020003131	Roller	4		
53	022900410	Roller ϕ12	8		
54	359200007	Spacer	2	C305	
55	022904321	Y Roller Collar	4		

No.	Part No.	Description	Q'ty	Remarks	
		(Pen Block Unit)			
				Standard Pressure Type	
60	022906313	MC Block	1		
61	090113200	Long Magnetic Circuit Board A	2	A0000	
62	010014101	Slide Shaft Assembly	2		
63	021500621	50 Slide Arm	2		
64	022906323	Hall IC Bracket	2		
65	053203350	Guide Shaft	2		
66	319011094	Bearing	4	BB692ZZ	
67	053203350	MC Up Spring	2		
68	340804012	O Ring,S4	2		
69	034004591	Offset Pin	2		
70	021500630	Cutter Holder	2		
71	302200029	Pen Mounting Screw M4 × L15	2		
73	022906354	Pen Cover	1		
74	022902412	Block Plate	1		
80	792232700	2 Pen Type Block Assembly	1	Standard Cutting Pressure	
81	792232701	2 Pen T Type Block Assembly	1	High Cutting Pressure	
E1	772232110	X-Y Joint Board	1	PR223225 Assembly	
E2	509410107	Y Motor	1	UGFMED A5TGR33 Y	
E3	772232140	2 Pen Joint Board	1	PR223229 Assembly	
E4	305320007	Moving Coil	1	PL-326B	
E5	110006060	Flexible Printed Circuit	1	FPC10002	
E6	792150709	Height Sensor	1		
E7	772230310	Y Limit Switch Assembly	1	PR229008 Assembly	
E8	772232130	Pen Flex. Board	1	PR223226 Assembly	
E9	162291100	Y Flexible Cable	1	FCASS91010	
E10	122907040	Cable	1	CA2290-04	
E11	792232704	2 Pen Type Board Assembly	1	PR223227 Assembly	
E11	792232705	2 Pen T Type Board Assembly	1	PR223227 Assembly	

Y Drive Section (2-PEN TYPE)



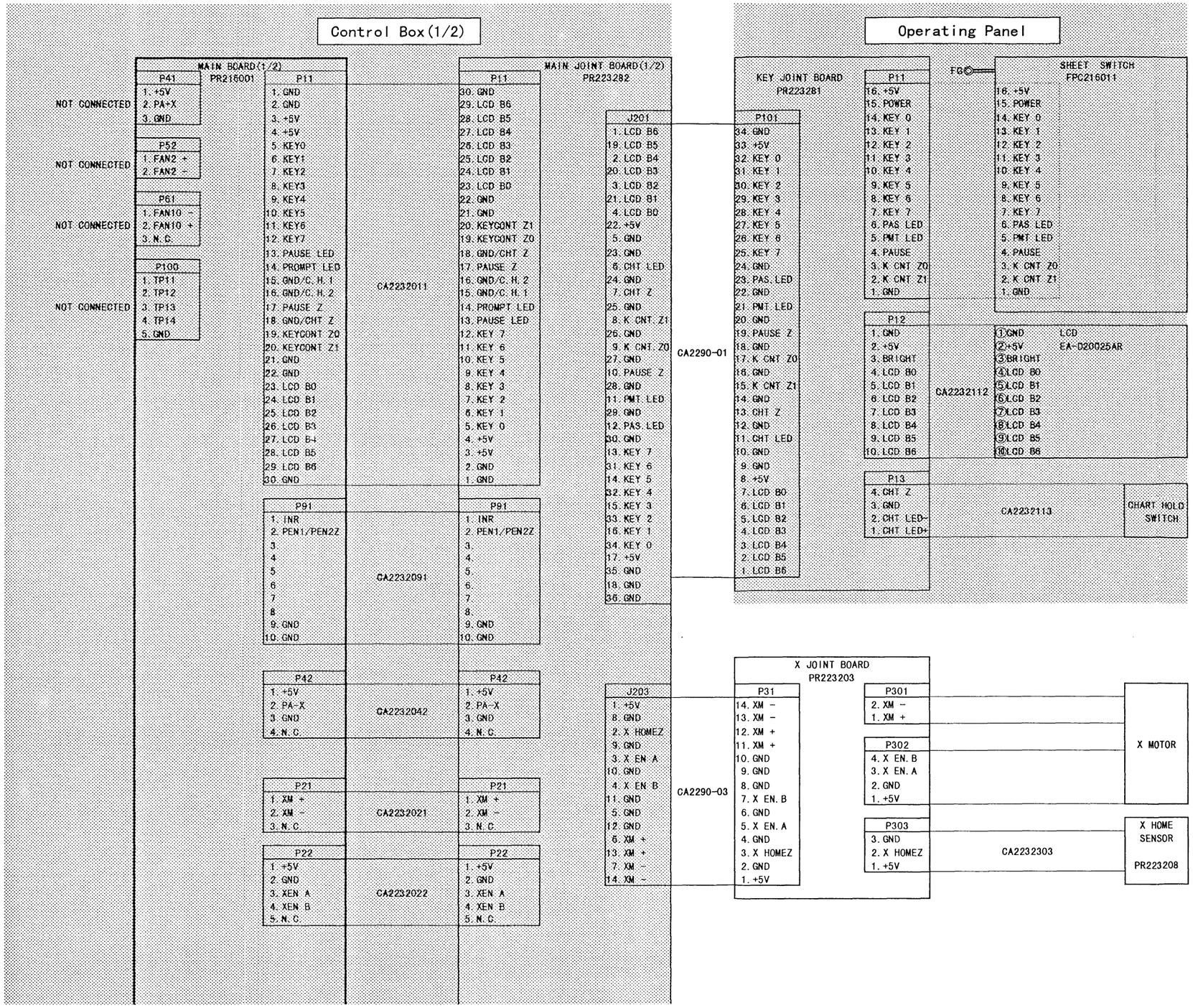
9.9 Roll Stocker (Option)

No.	Part No.	Description	Q'ty	Remarks	
1	022908050	Hanger, Front	1		
2	022908060	Hanger, Rear	1		
3	022908070	Roll Shaft	1		
4	022908080	Nut R16	1		
5	022908590	Tray Nut 18	2		
6	022908580	Tray Nut 12	2		
8	772290800	Hanger Assembly	1		

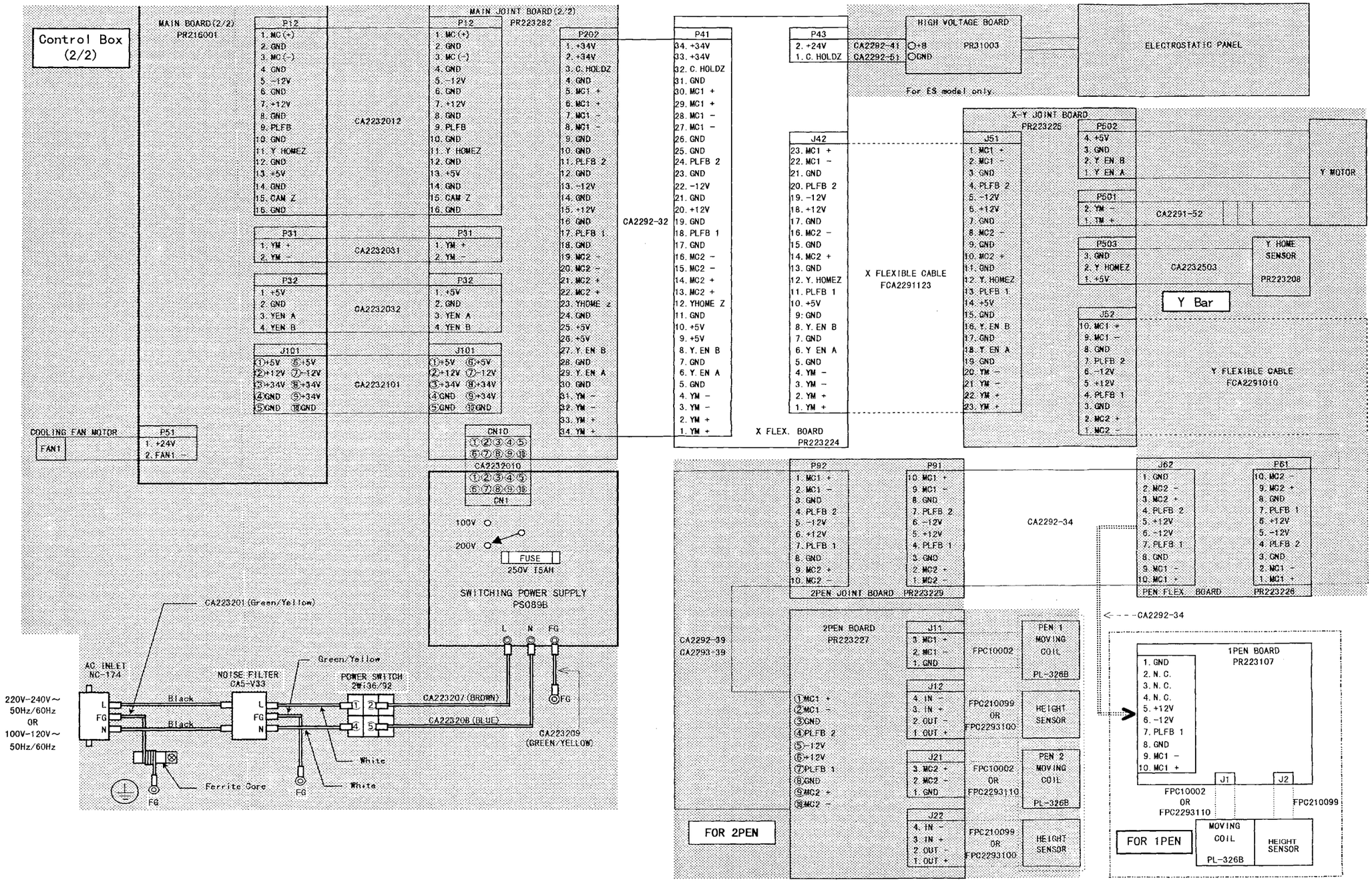
9.10 Pen block conversion set

No.	Part No.	Description	Q'ty	PEN TYPE	
1	792231700	Set to convert 1PEN-N to 1PEN-T	1	1N -> 1T	
2	792232701	Set to convert 1PEN-N to 2PEN-N	1	1N -> 2N	
3	792232703	Set to convert 1PEN-N to 2PEN-T	1	1N -> 1N1T	

Wiring Connection (1/2)

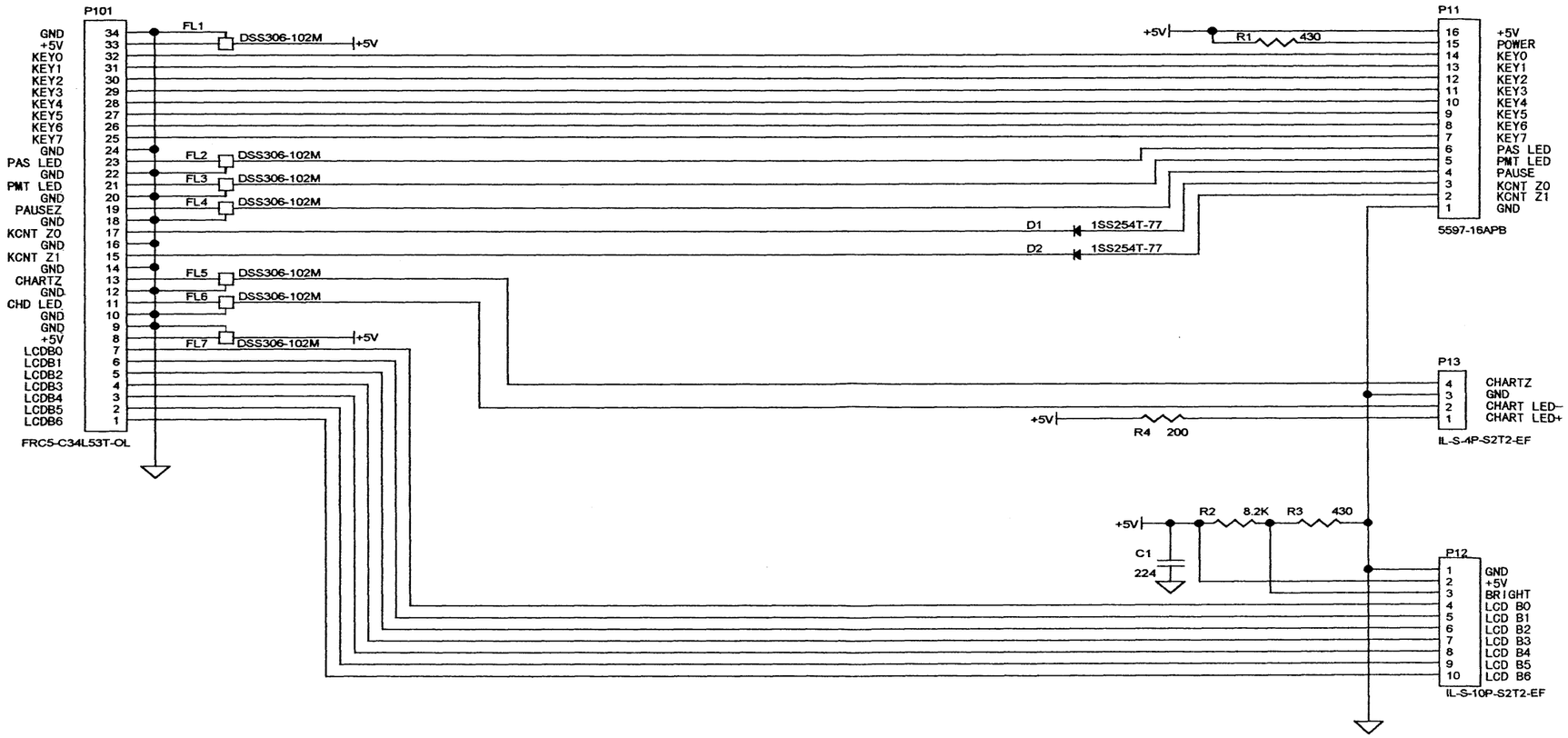


Wiring Connection (2/2)



10.2 Key Joint Board (PR223281)

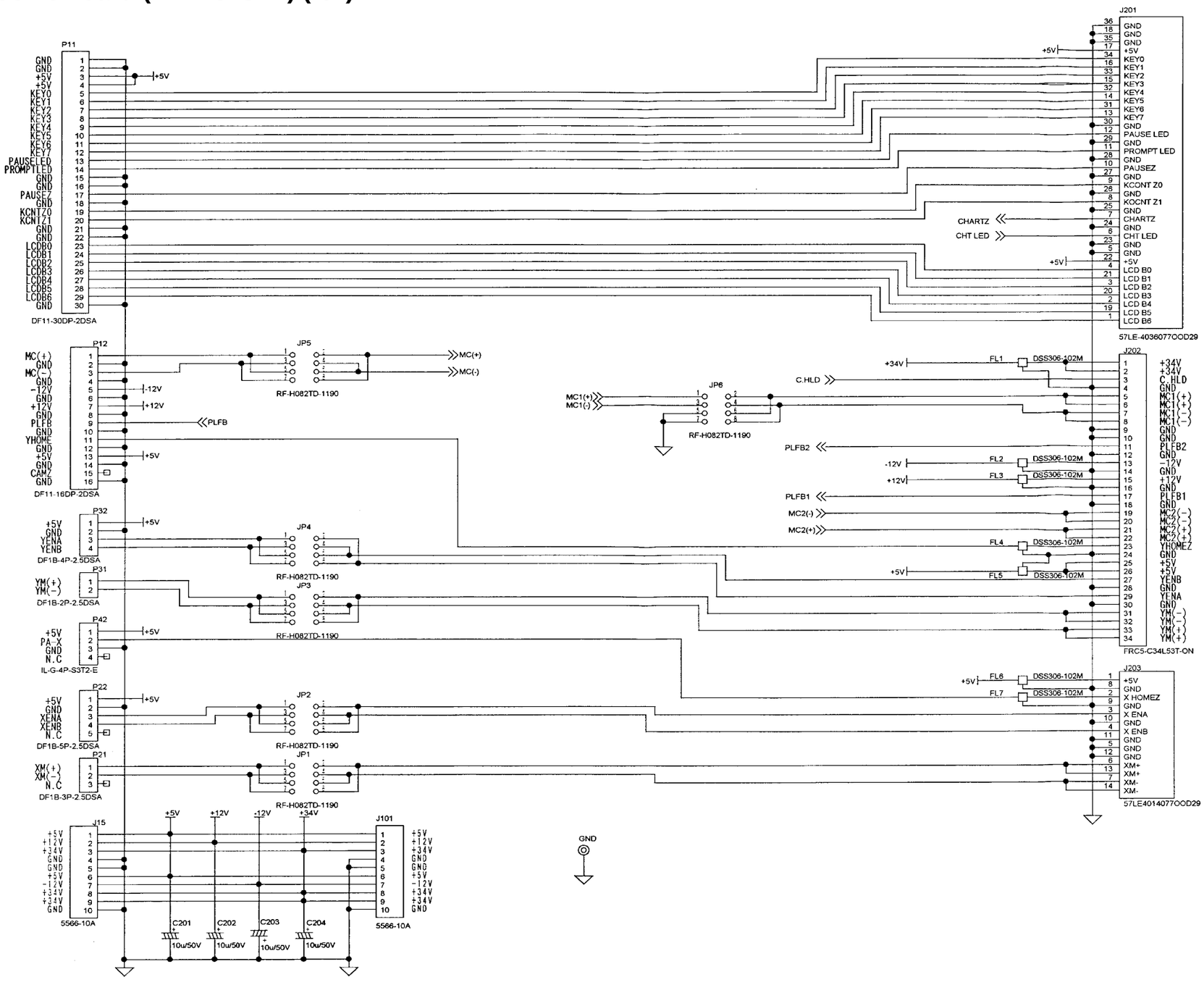
Circuit No.	Part No.	Description	Rating	Q'ty
PCB	682807810	PCB	PR223281	1
D1, 2	503000021	Diode	1SS254T-77	2
R2	501303749	Resistor	RNM1/4S-8.2KF	1
R4	501303744	Resistor	RNM1/4S-200ΩF	1
R1, 3	501303765	Resistor	RNM1/4S-430ΩF	2
C1	500000651	Capacitor, ceramic	CC, RPE132F224Z50	1
FL1, 2, 3, 4, 5, 6, 7	502010002	Filter	DSS306-55FZ103N1	7
P101	513101177	Connector	FRC5-C34L53T-OL	1
P11	513000188	Connector	5597-16APB	1
P13	513400296	Connector	IL-S-4P-S2T2-EF	1
P12	505200100	Connector	IL-S-10P-S2T2-EF	1



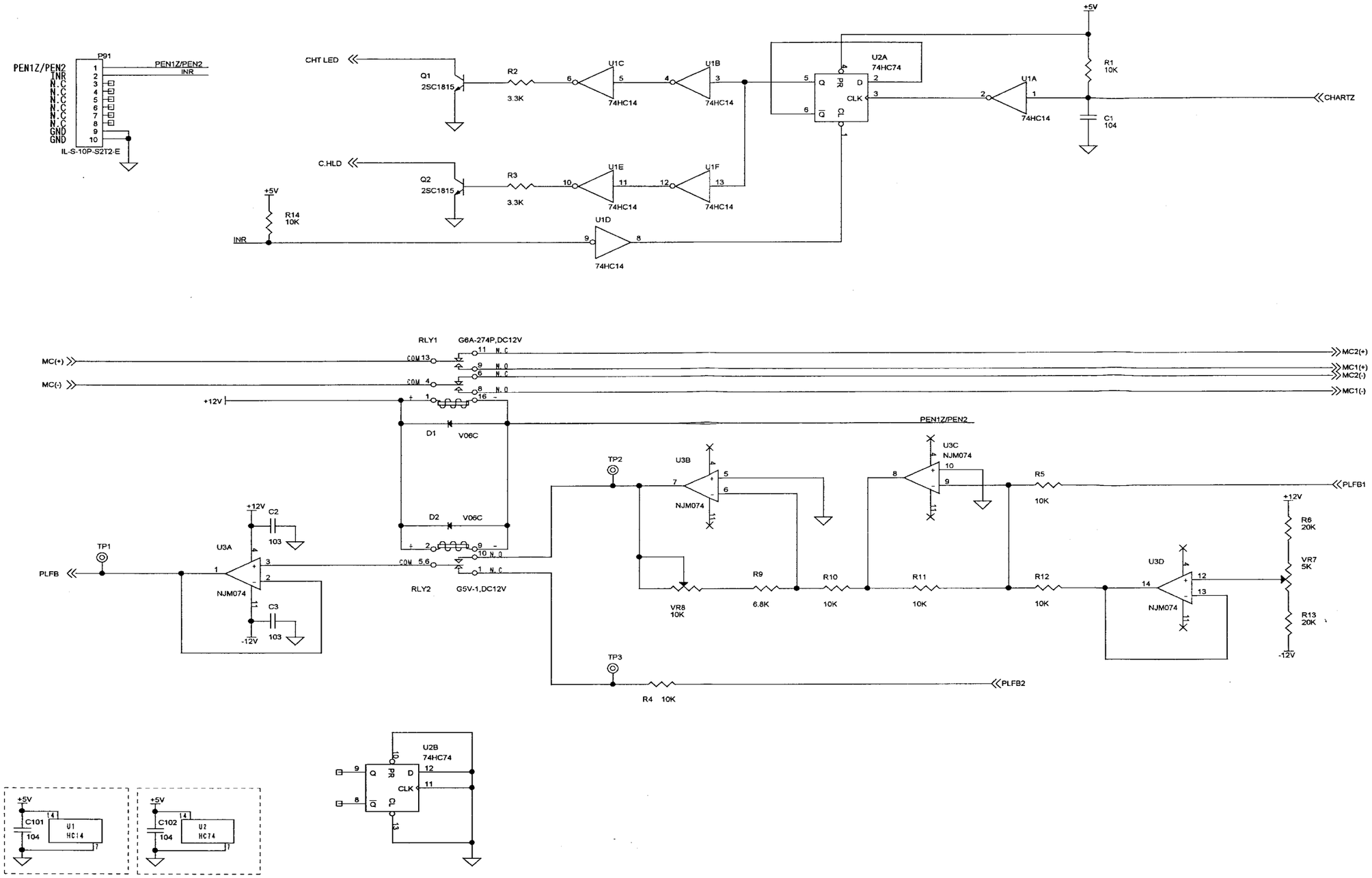
10.3 Main Joint Board (PR223282A)

Circuit No.	Part No.	Description	Rating	Q'ty
PCB	682807821	PCB	PR223282A	1
U1	503303887	IC	IC, TC74HC14P	1
U2	503303891	IC	IC, TC74HC74P	1
U3	503300158	IC	UPC4074C	1
Q1, 2	503203014	Transistor	ST, 2SC1815, Y	2
D1, 2	503100021	Diode	SD, V06C	2
RLY2	500050274	Relay	G5V-1, DC12V	1
RLY1	500050275	Relay	G6A-274P, DC12V	1

Main Joint Board (PR223282A) (1/2)

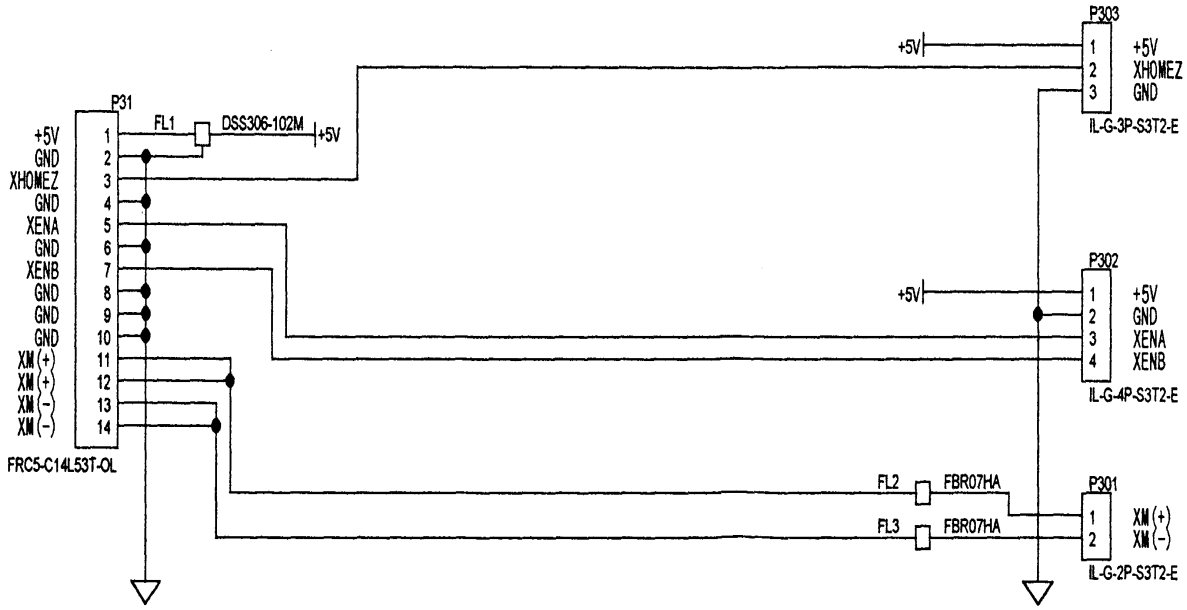


Main Joint Board (PR223282A) (2/2)



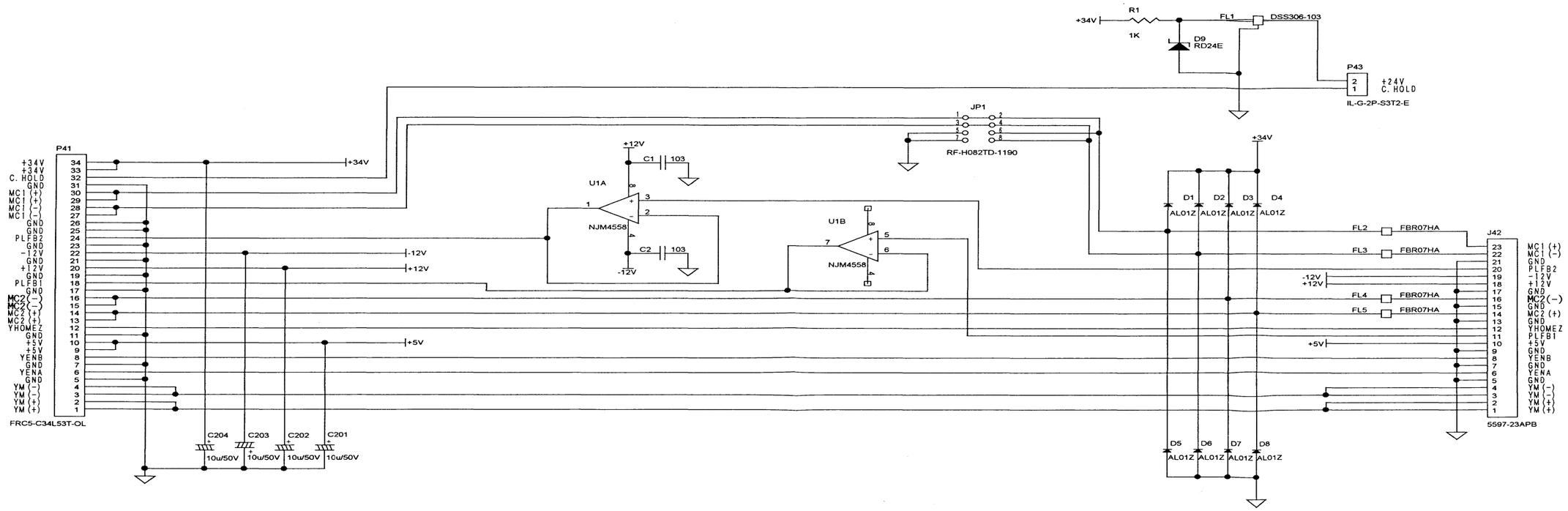
10.4 X Joint Board (PR223203)

Circuit No.	Part No.	Description	Rating	Q'ty
PCB	682807030	PCB	PR223203	1
FL1	502010002	Filter	DSS306-55FZ103N1	1
FL2, 3	518110088	Filter	FBR07HA850NB-00	2
P301	513101066	Connector	CN, 5566-02A	1
P31	513000001	Connector	FRC5-C14L53T-OL	1
P303	505100040	Connector	IL-G-4P-S3T2-E	1
P302	502312171	Connector	IL-G-3P-S3T2-E	1



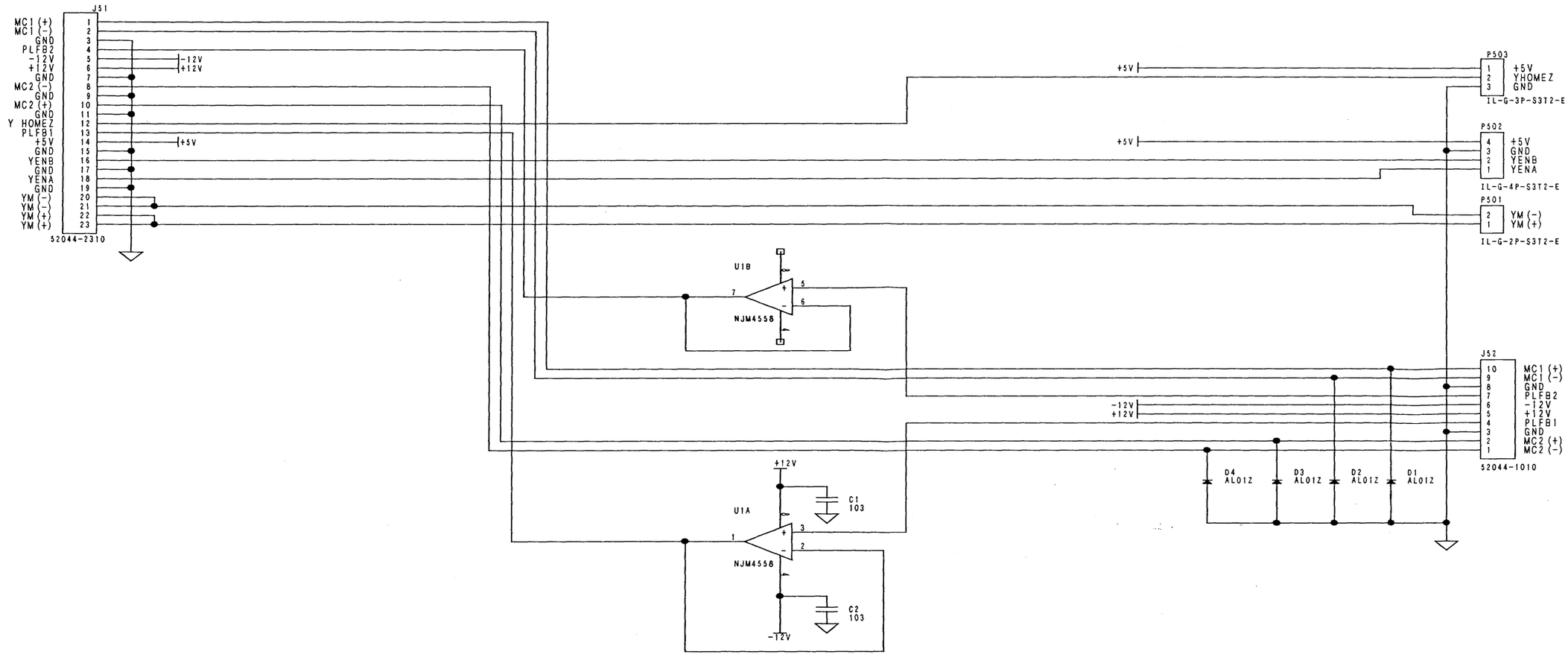
10.5 X Flex Board (PR223224A)

Circuit No.	Part No.	Description	Rating	Q'ty
PCB	682807241	PCB	PR223224A	1
U1	504084558	IC	NJM4558D	1
R1	501303712	Resister	RNM1/4S-1KF	1
C1, 2	500000645	Capacitor, ceramic	CC, RPU08F103Z-T	2
D1, 2, 3, 4, 5, 6, 7, 8	500000731	Diode	SD, AL01Z	8
D9	500000732	Diode	ZD, RD24E	1
FL1	502010002	Filter	DSS306-55FZ103N1	1
FL2, 3, 4, 5	518110088	Filter	FBR07HA850NB-00	4
J42	500050269	Connector	5597-23APB	1
P41	513101177	Connector	FRC5-C34L53T-OL	1
P43	502312170	Connector	IL-G-2P-S3T2-E	1
JP1	500050268	Jumper Pin	RF-082TD-1190	1
	513000055	Jumper Connector	JM-2BK-61	2
C201, 202, 203, 204	500050267	Capacitor	RT-050MG100MR	4



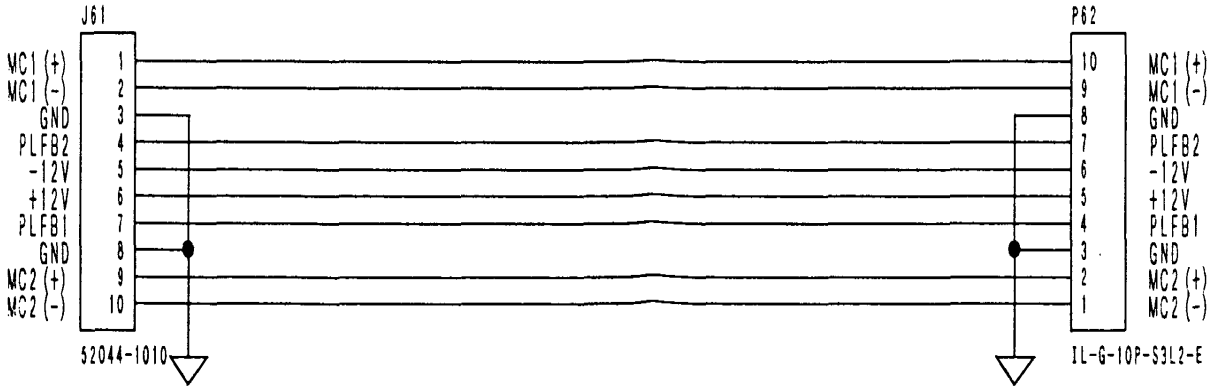
10.6 X-Y Joint Board (PR223225A)

Circuit No.	Part No.	Description	Rating	Q'ty
PCB	682807251	PCB	PR223225A	1
U1	504084558	IC	NJM4558D	1
D1,2,3,4	500000731	Diode	SD, AL01Z	4
C1,2	500000645	Capacitor, ceramic	CC, RPU08F103Z-T	2
J52	513101160	Connector	CN, 52044-1010	1
J51	513101159	Connector	CN, 52044-2310	1
P501	502312170	Connector	IL-G-2P-S3T2-E	1
P503	502312171	Connector	IL-G-3P-S3T2-E	1
P502	505100040	Connector	IL-G-4P-S3T2-E	1



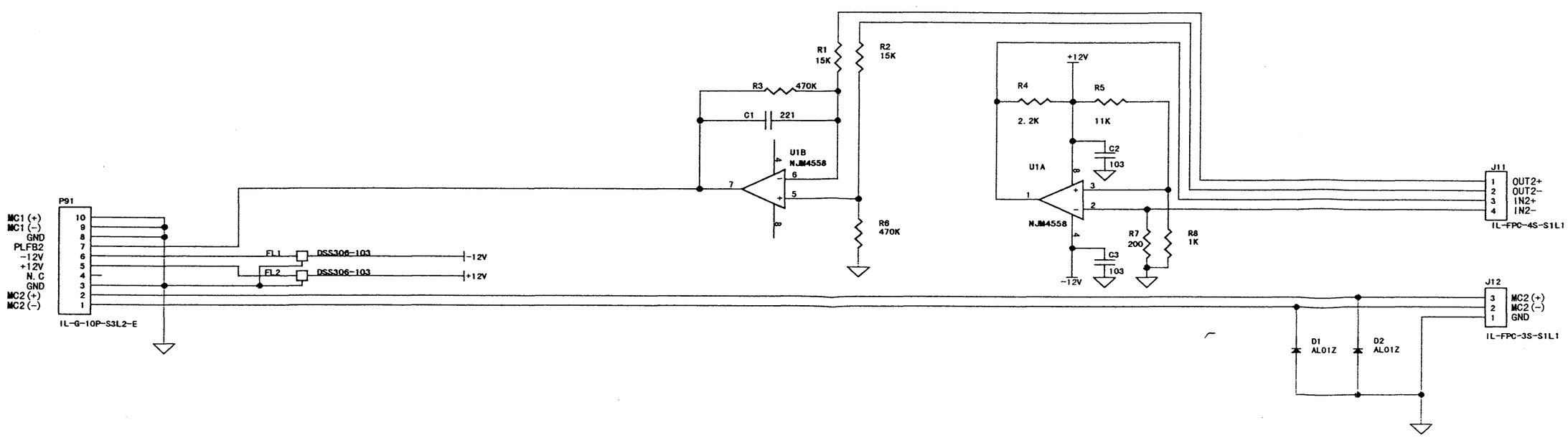
10.7 Pen Flex Board (PR223226A)

Circuit No.	Part No.	Description	Rating	Q'ty
PCB	682807261	PCB	PR223226A	1
J61	513101160	Connector	CN, 52044-1010	1
P62	513100926	Connector	CN, IL-G-10PS3L2E	1
	122927343	Cable	CA2292-34C	1



10.8 1-Pen Board (PR223107)

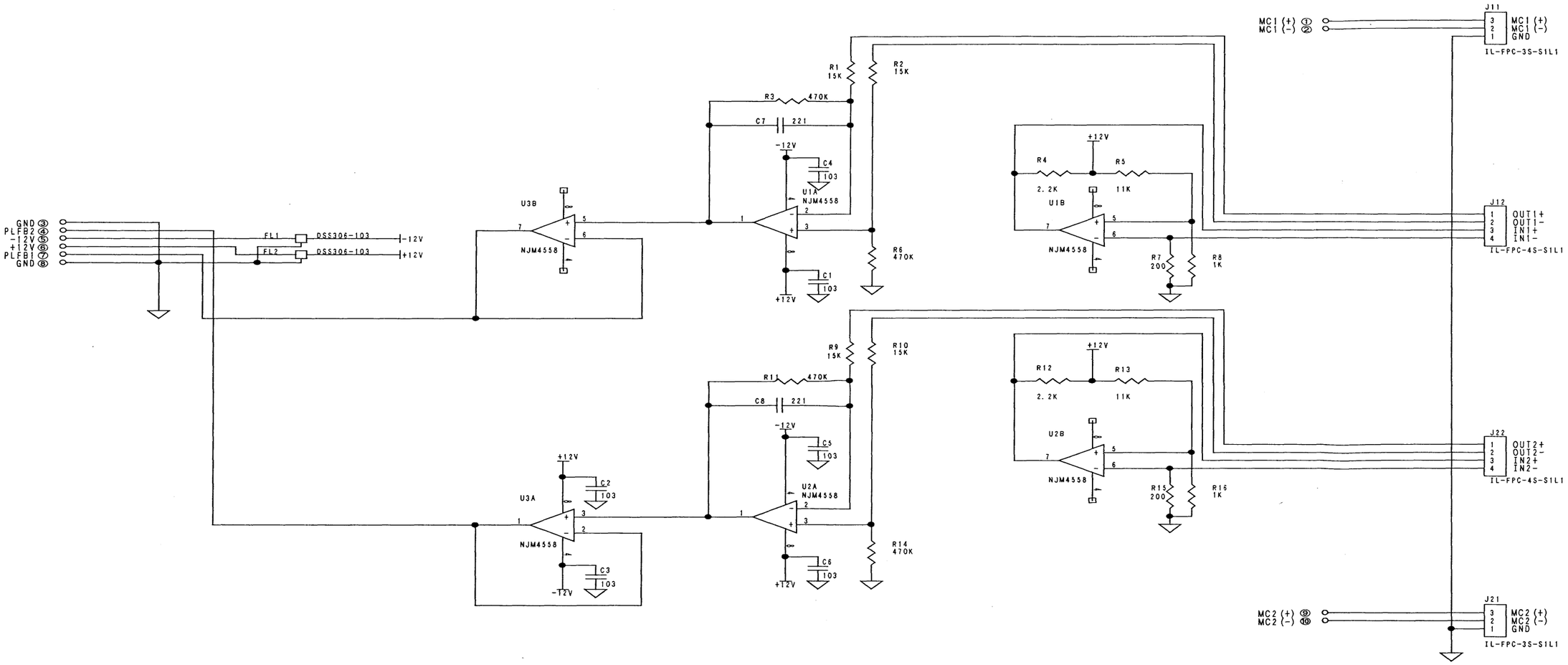
Circuit No.	Part No.	Description	Rating	Q'ty
PCB	682807070	PCB	PR223107	1
U1	504084558	IC	NJM4558D	1
R1, R2	501303777	Resistor	RNM1/4S-15KF	2
R3, R6	501303735	Resistor	RNM1/4S-470KF	2
R4	501303715	Resistor	RNM1/4S-2.2KF	1
R5	501303779	Resistor	RNM1/4S-11KF	1
R7	501303744	Resistor	RNM1/4S-200ΩF	1
R8	501303712	Resistor	RNM1/4S-1KF	1
C1	500000642	Capacitor, ceramic	CC, RPU04B221K-T	1
C2, C3	500000645	Capacitor, ceramic	CC, RPU08F103Z-T	2
D1, D2	500000731	Diode	SD, AL01Z	2
FL1, FL2	502010002	Filter	DSS306-55FZ103N1	2
J11	505000040	Connector	IL-FPC-4S-S1L1	1
J12	513100949	Connector	CN, IL-FPC3S-S1L1	1
P91	513100926	Connector	CN, IL-G-10PS3L2E	1



10.9 Pen Board (PR223227A)

Circuit No.	Part No.	Description	Rating	Q'ty
PCB	682807271	PCB	PR223227A	1
U1, 2, 3	504084558	IC	NJM4558D	3
R8, 16	501303712	Resistor	RNM1/4S-1KF	2
R4, 12	501303715	Resistor	RNM1/4S-2.2KF	2
R5, 13	501303779	Resistor	RNM1/4S-11KF	2
R1, 2, 9, 10	501303777	Resistor	RNM1/4S-15KF	4
R3, 611, 14	501303735	Resistor	RNM1/4S-470KF	4
R7, 15	501303744	Resistor	RNM1/4S-200ΩF	2

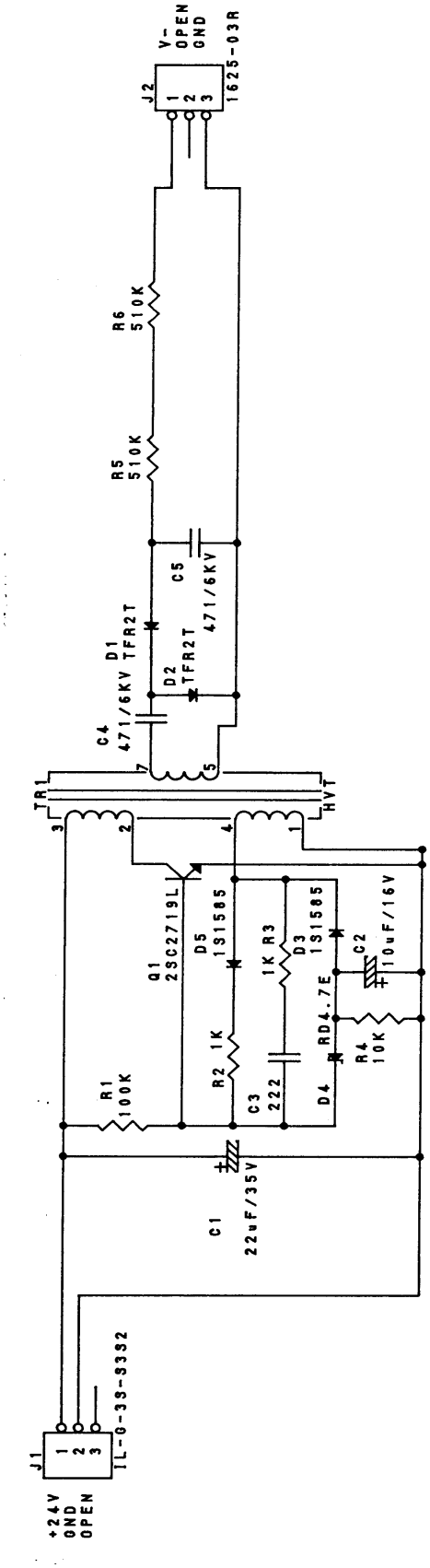
Circuit No.	Part No.	Description	Rating	Q'ty
C7, 8	500000642	Capacitor, ceramic	CC, RPU04B221K-T	2
C1, 2, 3, 4, 5, 6	500000645	Capacitor, ceramic	RPU08F103Z-T	6
FL1, 2	502010002	Filter	DSS306-55FZ103N1	2
J11, 21	513101038	Connector	IL-FPC-3S-S1L1	2
J12, 22	505000040	Connector	IL-FPC-4S-S1L1	2



10.10 High Voltage Board (PR31001C)

Circuit No.	Part No.	Description	Rating	Q'ty
Q1	503203071	Transistor	2SC2719L	1
D1, 2	503100181	Diode	SD, TFR2T	2
D4	503100172	Diode	SD, RD4.7E-B3	1
D3, 5	503100173	Diode	SD, 1S1585	2
L1	510033250	Transformer	HVT, 31001C	1
R1	501303810	Resistor	R20T-24J104	1
R2, 3	501303797	Resistor	R20T-24J102	2
R5, 6	501303811	Resistor	R20T-24J514	2
R4	501303805	Resistor	R20T-24J103	1
C1	502102224	Capacitor, Electrolytic	CE, 35UTCMDT220	1
C2	502102225	Capacitor, Electrolytic	CE, 16UTCMDT100	1
C3	502403105	Capacitor	CC, RPU05B222K	1
C4, C5	502103101	Capacitor, Ceramic	DE, 1010B471K6KV	2
	773503490	High Voltage Board	PR31001C Assembly	1

High Voltage Board (PR31001C)



10.11 Main Board (PR216001B) (1/3)

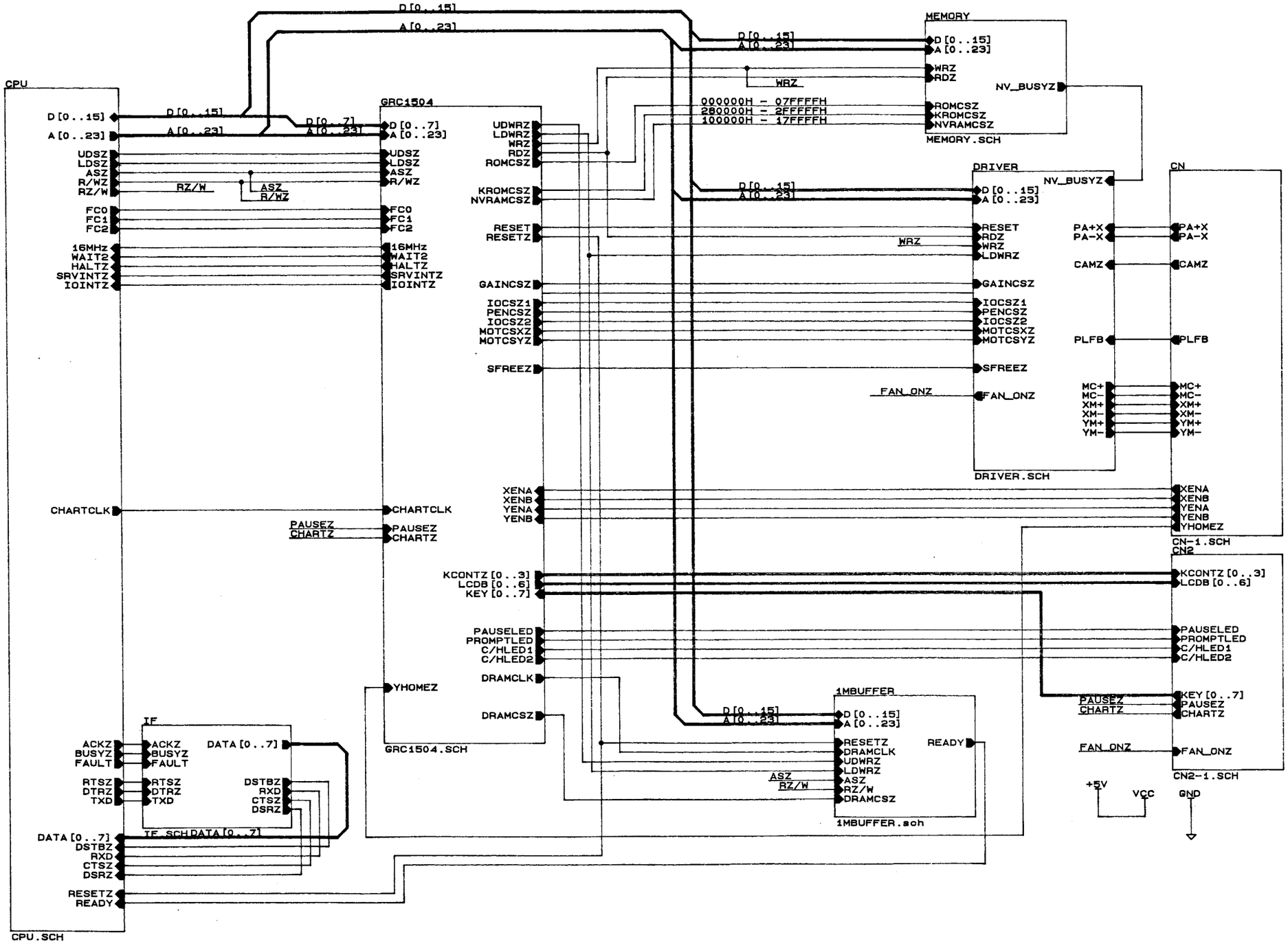
Circuit No.	Part No.	Description	Rating	Q'ty
PCB	121606012	PCB	PR216001B	1
U1	503300025	Driver/Receiver	MC145406FL	1
U2, U3	503300006	HC-MOS	TC74HC14AF-EL	2
U4	503300004	HC-MOS	TC74HC04AF-EL	1
U5	503300012	HC-MOS	TC74HC164AF-E	1
U6	503300089	C-MOS	TC74AC151F-EL	1
U7	503300007	HC-MOS	TC74HC32AF-EL	1
U8	503300162	MPU	TMP68301AF-16	1
U12	503300149	EEP ROM	HN58C65RFP25TZ	1
U13	503300066	CUSTOM IC	GRC1503	1
U14, 15	503300113	D RAM	μPD424800LE-70L-	2
U16, 27	503300163	D/A Converter	DAC7802KU-001	2
U17, 29, 30	503300111	OP Amp	NJM074M-TE2	3
U18	503300155	A/D Converter	ADS7800JUEL	1
U19, 20	503300080	HC-MOS	TC74HC244AFEL	2
U21, 24	503300109	Comparator	NJM2903M-TE3	2
U22, 26	503301227	CUSTOM IC	GRC1001	2
U23, 25	503301226	PWM Controller	IXMS150PSC	2
U28	503300139	D/A Converter	MB88351PF-G	1
U31	500050020	PPI	MB89255BH-PFS-G	1
U32	503300148	Transistor Array	μPA2003GRE2	1
U33	503300147	C-MOS	TC74AC139F-EL	1
U34	503300136	CUSTOM IC	GRC1504A	1
U35	503300020	TTL	HD74LS06FPEL	1
U36	519000007	Oscillator	JX0-7(32.0MHz)	1
U37	503300090	Reset IC	PST592DMT	1
U38	503300152	Line Receiver	HD75189AFPEL	1
U39	503300154	DC/DC Converter	MC34063AMEL	1
	500002036	Socket	DICF-24CS-E1	2
QA1, 2, 3	503301229	MOS FET Array	SLA5013	3
Q1	503000016	Transistor	2SC4112-TA	1
Q2	503000024	Transistor	2SD1286-Z-T1	1
DA1	503100180	Diode Array	DAN801	1
D1 - 8, 12 - 16	503000022	Diode	AL01ZV0	13
D9, 10	503000008	Diode	1SS220-T1B	2
D11	503000020	Diode	HZM7.5NB2TL	1
R1 - 6, 41, 90	501305072	Resistor	MCR10EZHJ102	8
R7 - 20	501305035	Resistor	MCR10EZHJ300	14
R21, 24, 70	500000196	Resistor	RR1220P-203-D	3
R22, 23, 25, 26, 71	500000194	Resistor	RR1220P-103-D	5
R27, 28, 76	501305040	Resistor	MCR10EZHJ470	3
R29, 30	501305086	Resistor	MCR10EZHJ392	2
R31	501305095	Resistor	MCR10EZHJ912	1
R32,101	501305103	Resistor	MCR10EZHJ203	2
R33	501305105	Resistor	MCR10EZHJ243	1
R34, 48, 57, 78, 79, 82, 86	501305096	Resistor	MCR10EZHJ103	7
R35, 47, 63, 66	501305111	Resistor	MCR10EZHJ433	4

Circuit No.	Part No.	Description	Rating	Q'ty
R36, 37, 42, 44 - 46, 61, 62, 64, 72 - 75	501305120	Resistor	MCR10EZHJ104	13
R38, 39	501305108	Resistor	MCR10EZHJ333	2
R40, 54, 65	500000307	Resistor	ERG1SJ390V	3
R43, 67	501305097	Resistor	MCR10EZHJ113	2
R49	500001744	Resistor	MCR10EZH512J	1
R50, 51, 201	501305144	Resistor	MCR10EZHJ000	3
R55, 58	501305079	Resistor	MCR10EZHJ202	2
R56	501305082	Resistor	MCR10EZHJ272	1
R59, 60	500000003	Resistor	MPC70-0.15Ω	2
R68, 88	500000071	Resistor	MPC70-0.47Ω	2
R77	501305100	Resistor	MCR10EZHJ153	1
R80, 91	500000296	Resistor	MCR25JZH121	2
R81	500000314	Resistor	RR1220P-512-D	1
R85, 87	501305084	Resistor	MCR10EZHJ332	2
R89	501305102	Resistor	MCR10EZHJ183	1
R92 - 96	501305063	Resistor	MCR10EZHJ431	5
R83	501305092	Resistor	MCR10EZHJ682	1
RA1	500000312	Resistor Array	RMLS4TM-J102	1
RA2, 3, 7, 14, 15	500000313	Resistor Array	RMLS8TM-J103	5
RA4-6,8-12	500000311	Resistor Array	RMLS8TM-J223	8
RA13	500000309	Resistor Array	RMLS4TM-J471	1
VR1, 2, 3	500050023	Variable Resistor	GV6V-50K	3
VR10, 20	504000037	Variable Resistor	CT-6TH20K	2
C1 - 10, 12 - 18, 21, 28, 29, 39, 45, 55, 60, 62, 67, 72, 73, 75, 77 - 80	502000012	Capacitor Ceramic	GRM40F104Z25P	33
C19, 20	502000073	Capacitor Electrolytic	ECEV1CA100R	2
C22, 23, 26, 34 - 37, 47, 50 - 53, 61, 64 - 66, 69, 70	502000009	Capacitor Ceramic	GRM40B103K50P	18
C24, 25, 63	502000062	Capacitor Ceramic	GRM40CH100D50PT	3
C27	502000003	Capacitor Ceramic	GRM40CH151K50	1
C30	502000044	Capacitor Electrolytic	ECEV1HA010R	1
C31	502000092	Capacitor Electrolytic	ECEV1EF6R8R	1
C32	502000087	Capacitor Electrolytic	ECEV1HAN010R	1
C33, 86	502000094	Capacitor Electrolytic	ECEV1VA470P	2
C38, 54	502000004	Capacitor Ceramic	GRM40CH181K50	2
C40, 41, 56	502000008	Capacitor Ceramic	GRM40B472K50P	3
C42, 58	502000075	Capacitor Electrolytic	50UTSST221	2
C43, 57	502000051	Capacitor Ceramic	GRM40F104Z50PT	2
C44, 48, 59	502000007	Capacitor Ceramic	GRM40B152K50P	3
C46	502000011	Capacitor Ceramic	GRM40F473Z50P	1
C49	502102266	Capacitor Electrolytic	16UTSST101	1
C68	502000093	Capacitor Electrolytic	ECEV1AA221P	1
C71, 74, 81 - 84	502000006	Capacitor Ceramic	GRM40B102K50P	6
C85	502000060	Capacitor Ceramic	GRM40B681K50PT	1
C87 - 90	502000095	Capacitor Electrolytic	ECEV1HA100P	4

10.11 Main Board (PR216001B) (3/3)

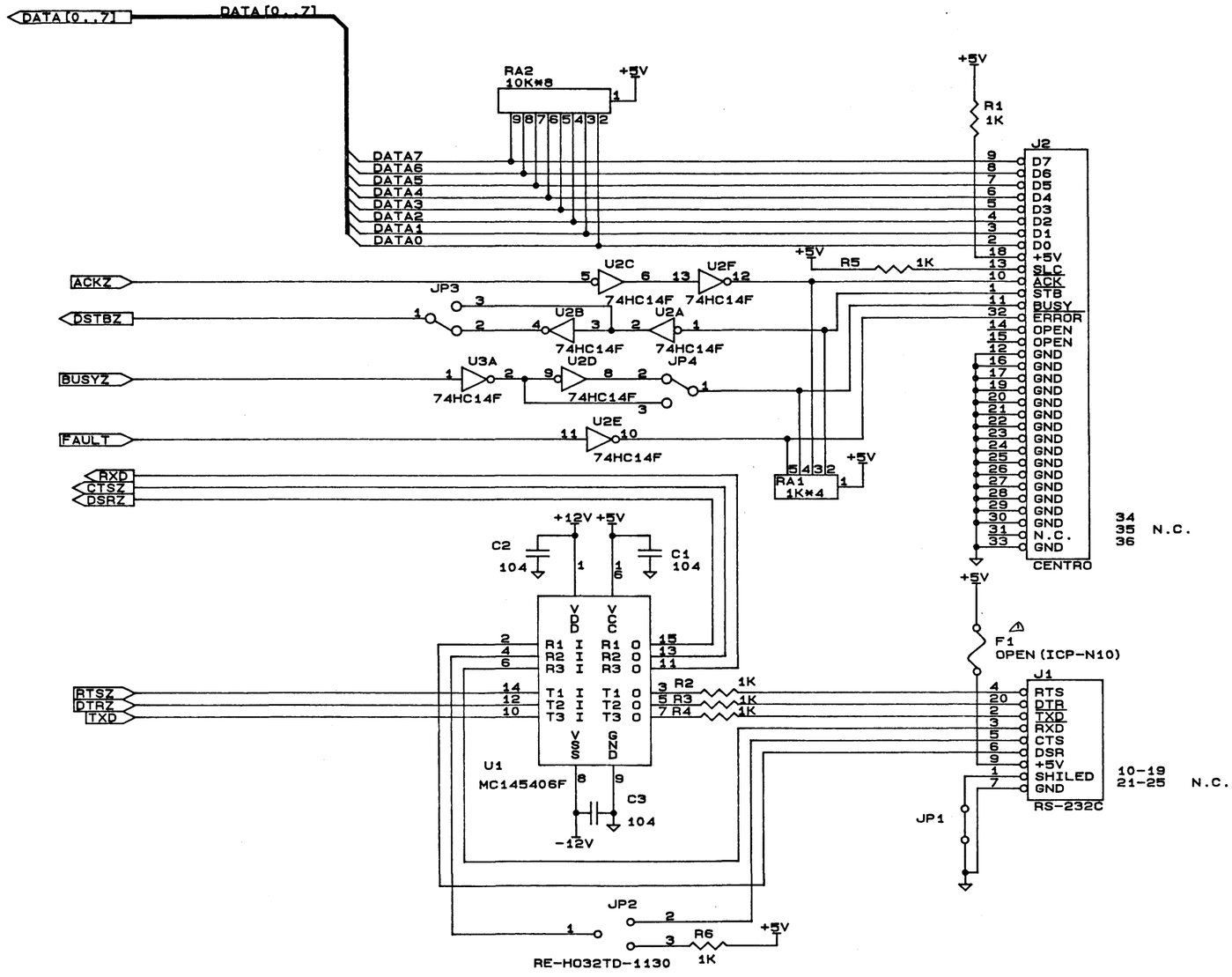
Circuit No.	Part No.	Description	Rating	Q'ty
FL1, 2	518000035	Filter	NFV510-655T2A107	2
FL3 - 6	518110088	Filter	FBR07HA850TB-00	4
FL11 - 21	518110095	Filter	STY103NBTB	11
FL31 - 38	518000010	Filter	DSS306-91B102M	8
FL120 - 130	518000032	Filter	EXC-CET102	11
L1	518000025	Coil	LHL08TB221K	1
FLA1, 2	518000029	Filter	NFA81R10C102	2
BZ1	520000020	Beeper	MEB-12B-12	1
SW1	508102243	Switch	KSD08	1
TP1 - 5, 10	513000169	Test Pin	HK-2-S	6
JP2	513000054	JP connector	RE-H032TD-1130	1
JP11	513000168	JP connector	RF-H122TD-1190	1
JP2, JP11	513000055	Socket	JM-2BK-61	4
IC10, IC11	513101077	IC Socket	DICF-32CS	2
J1	513000005	Connector	FCN675J025-L/C#U	1
J2	513000006	Connector	FCN685J036-L/Y	1
P11	513000127	Connector	DF11-30DP-2DSA	1
P12	513101230	Connector	DF11-16DP-2DSA	1
P21	513000057	Connector	B3B-XH-A	1
P22	513000195	Connector	DF1B-5P-2.5DSA	1
P31	513000063	Connector	B2B-XH-A	1
P32	513000194	Connector	DF1B-4P-2.5DSA	1
P41	513000155	Connector	B3B-PH-K	1
P42	513000156	Connector	B4B -PH-K	1
P51, 52	513000192	Connector	DF1B-2P-2.5DSA	2
P61	513000193	Connector	DF1B-3P-2.5DSA	1
P91	513101064	Connector	IL-S-10P-S2T2-EF	1
J101	513100989	Connector	5566-10A	1
P100	513100976	Connector	IL-S-5P-S2T2-EF	1
	503300044	ROM	HN27C101AG-20	1
	772160010	Main Board	PR216001B	1

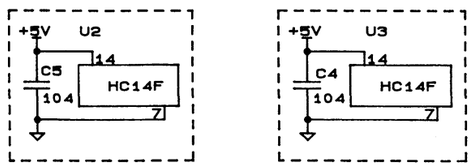
Main Board (1/17)



Main Board (2/17)

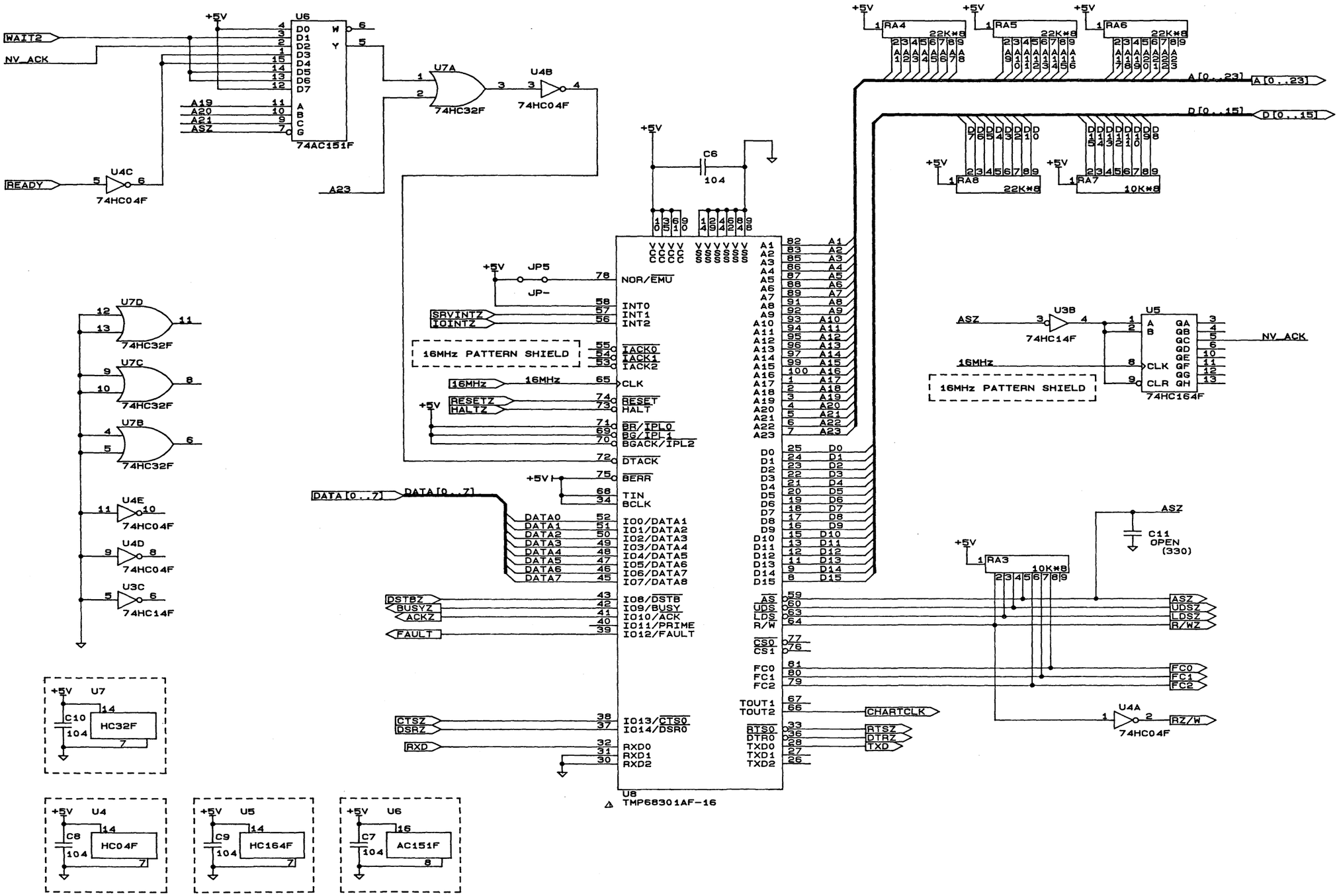
Interface Section





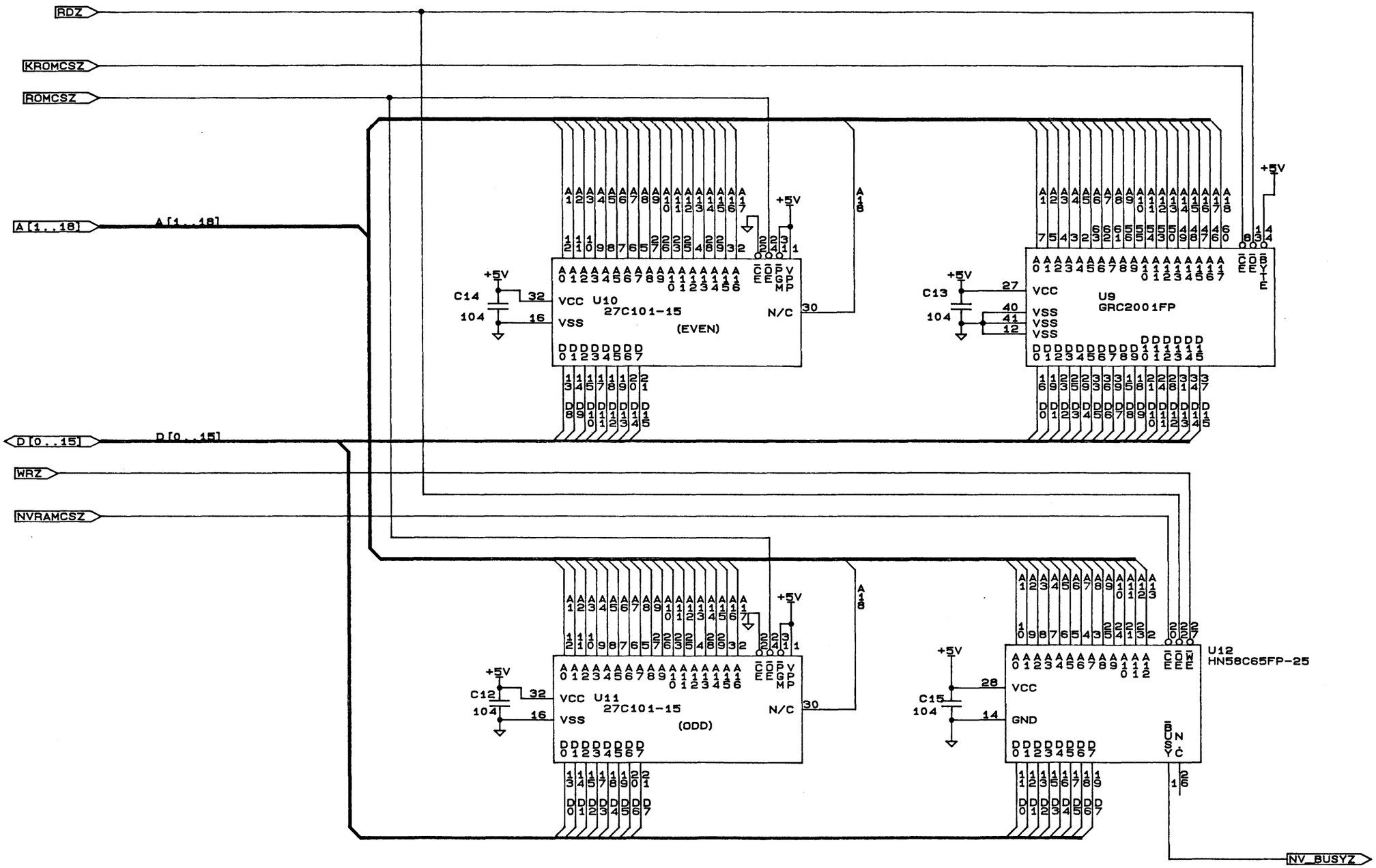
Main Board (3/17)

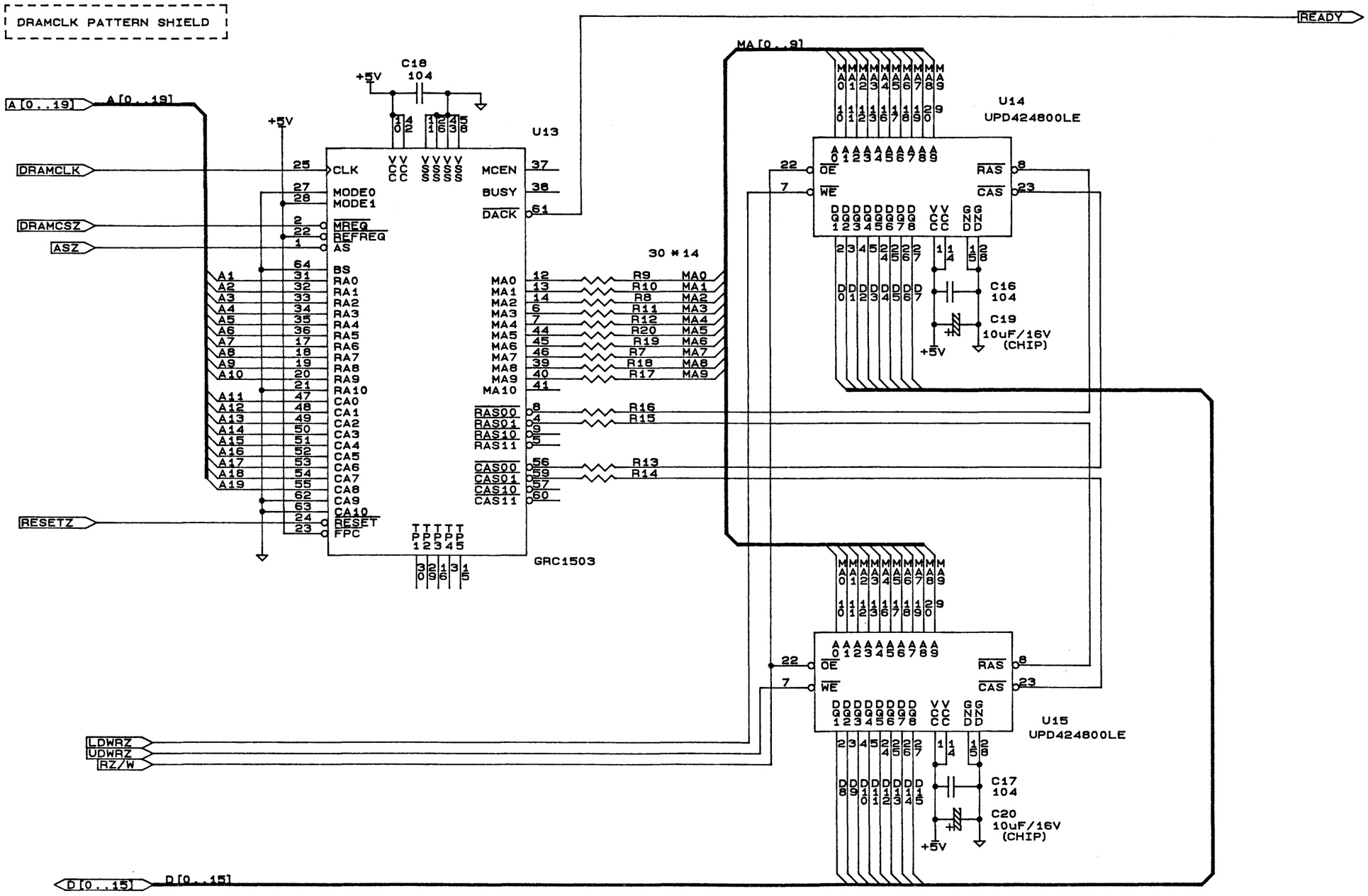
CPU Section



Main Board (4/17)

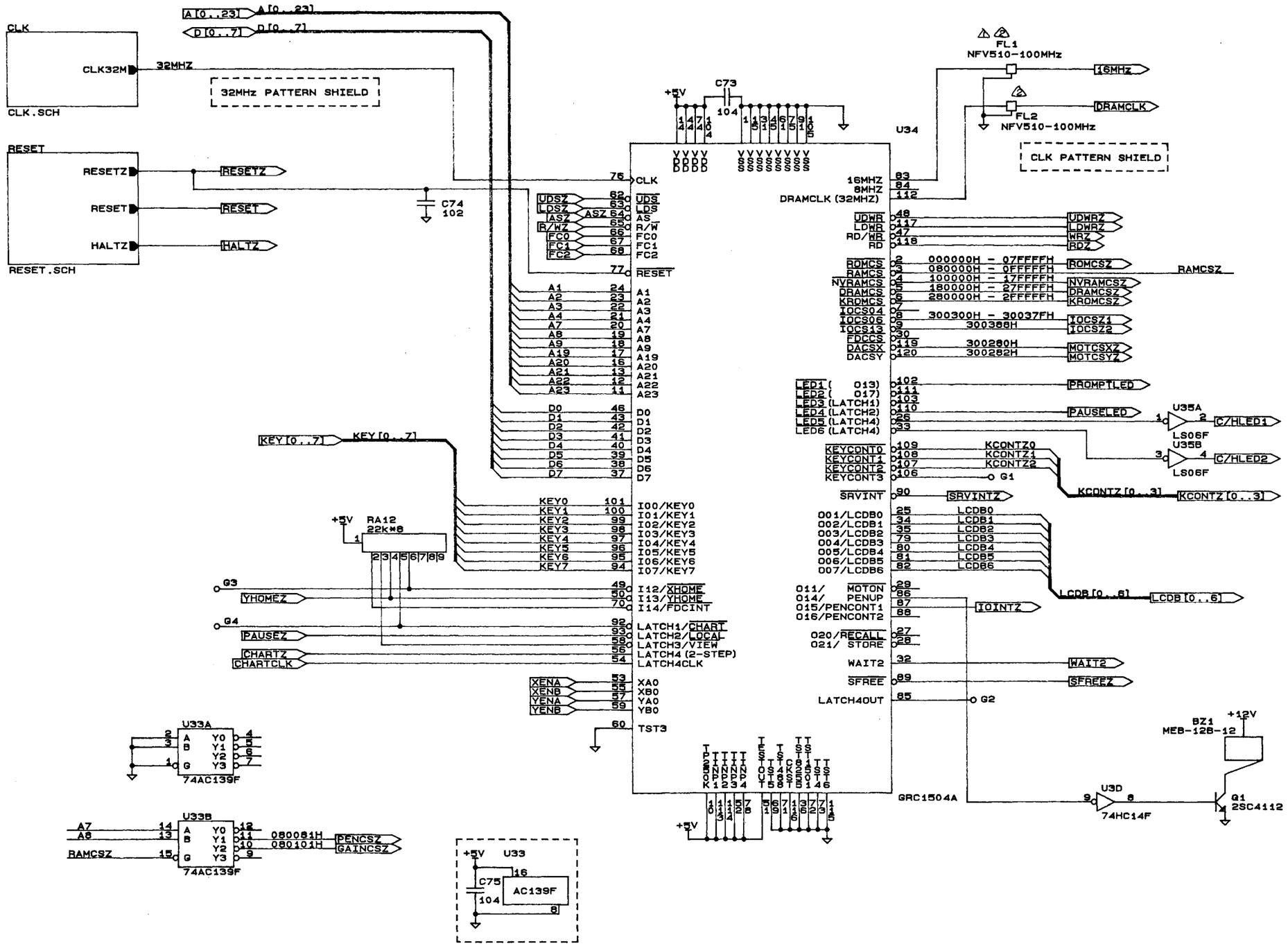
Memory Section




DRAMCLK PATTERN SHIELD
READY
A[0..19]
A[0..19]
+5V
C18
104
U13
DRAMCLK
DRAMCSZ
ASZ
RESETZ
CLK
MODE0
MODE1
MREQ
REFREQ
AS
BS
RA0
RA1
RA2
RA3
RA4
RA5
RA6
RA7
RA8
RA9
RA10
CA0
CA1
CA2
CA3
CA4
CA5
CA6
CA7
CA8
CA9
CA10
RESET
FPC
MCEN
BUSY
DACK
MA0
MA1
MA2
MA3
MA4
MA5
MA6
MA7
MA8
MA9
MA10
RAS00
RAS01
RAS10
RAS11
CAS00
CAS01
CAS10
CAS11
30 * 14
R9
R10
R8
R11
R12
R20
R19
R7
R18
R17
R16
R15
R13
R14
GRC1503
MA[0..9]
U14
UPD424800LE
OE
WE
RAS
CAS
C16
104
C19
10uF/16V
(CHIP)
U15
UPD424800LE
C17
104
C20
10uF/16V
(CHIP)
LDWRZ
UDWRZ
RZ/W
D[0..15]
D[0..15]

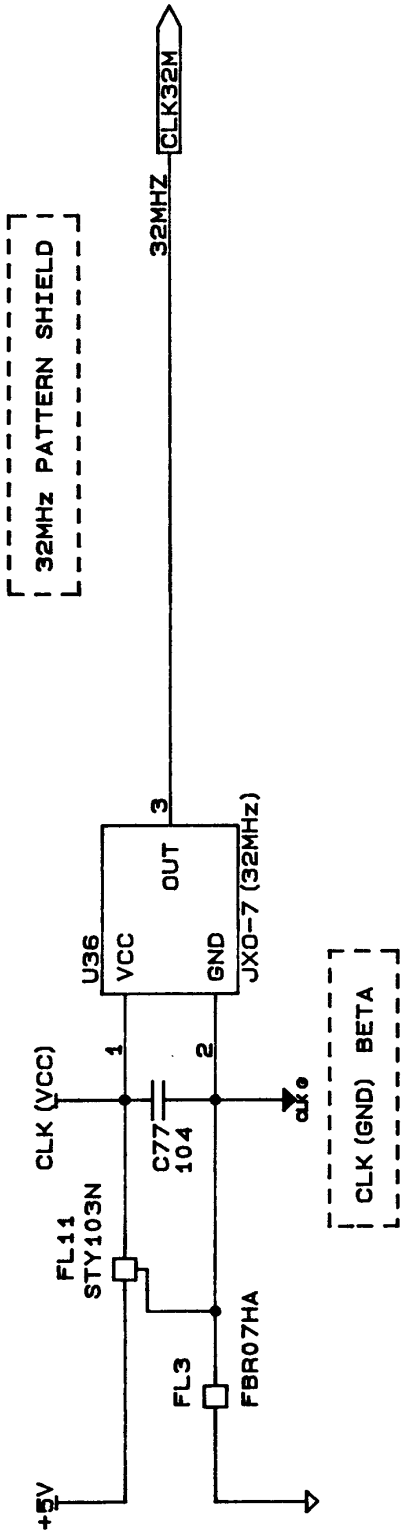
Main Board (6/17)

GRC 1504 Section



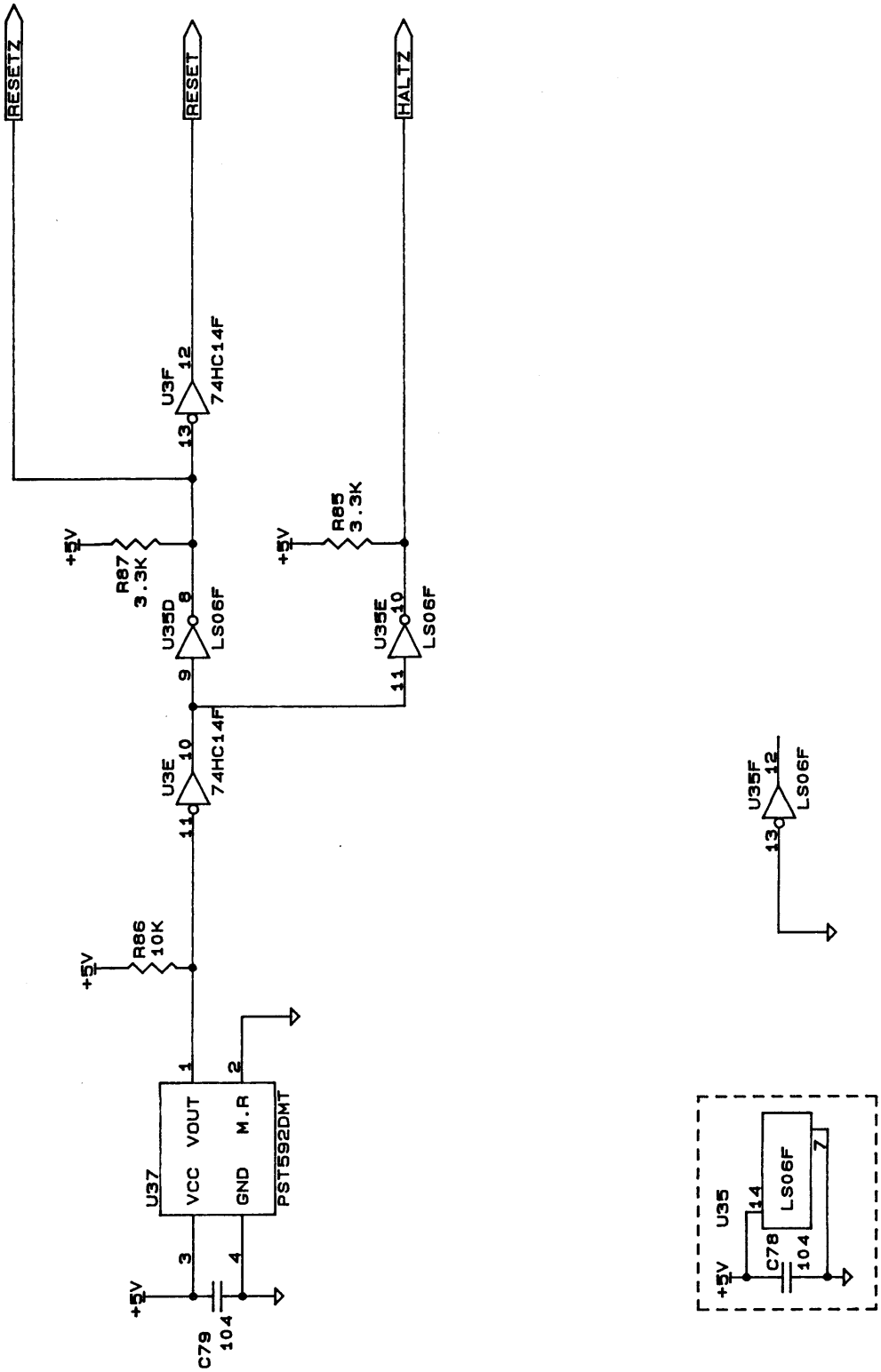
Main Board (7/17)

Clock Section



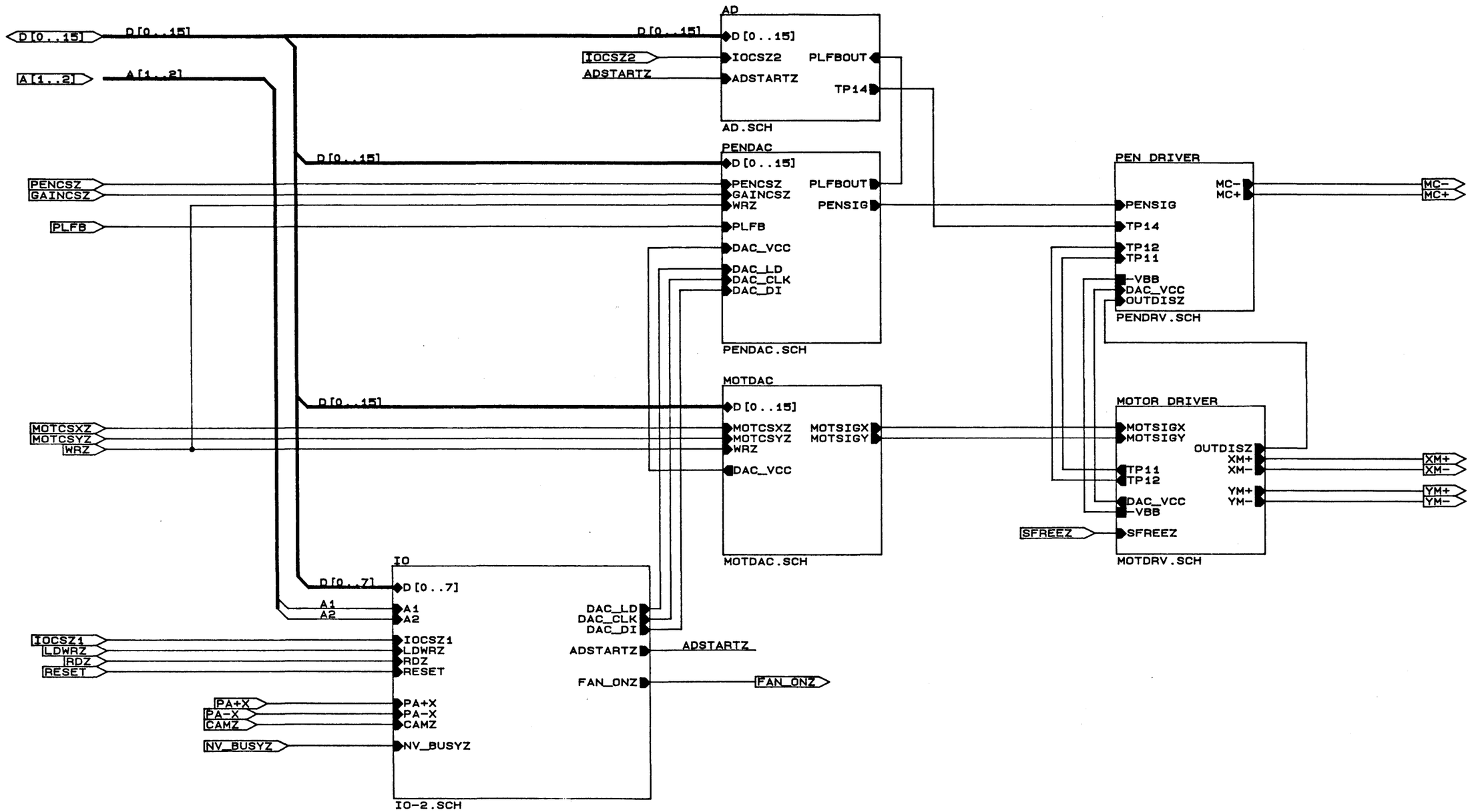
Main Board (8/17)

Reset Section



Main Board (9/17)

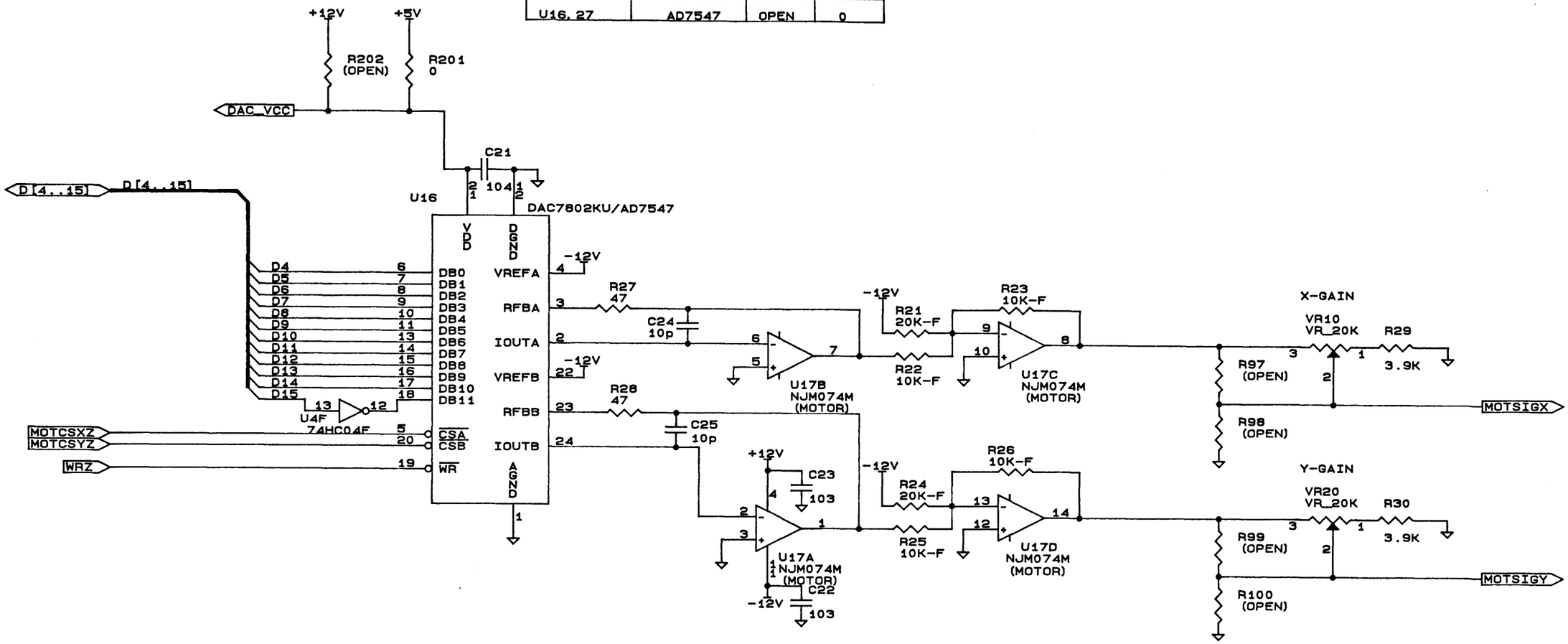
Driver Section



Main Board (10/17)

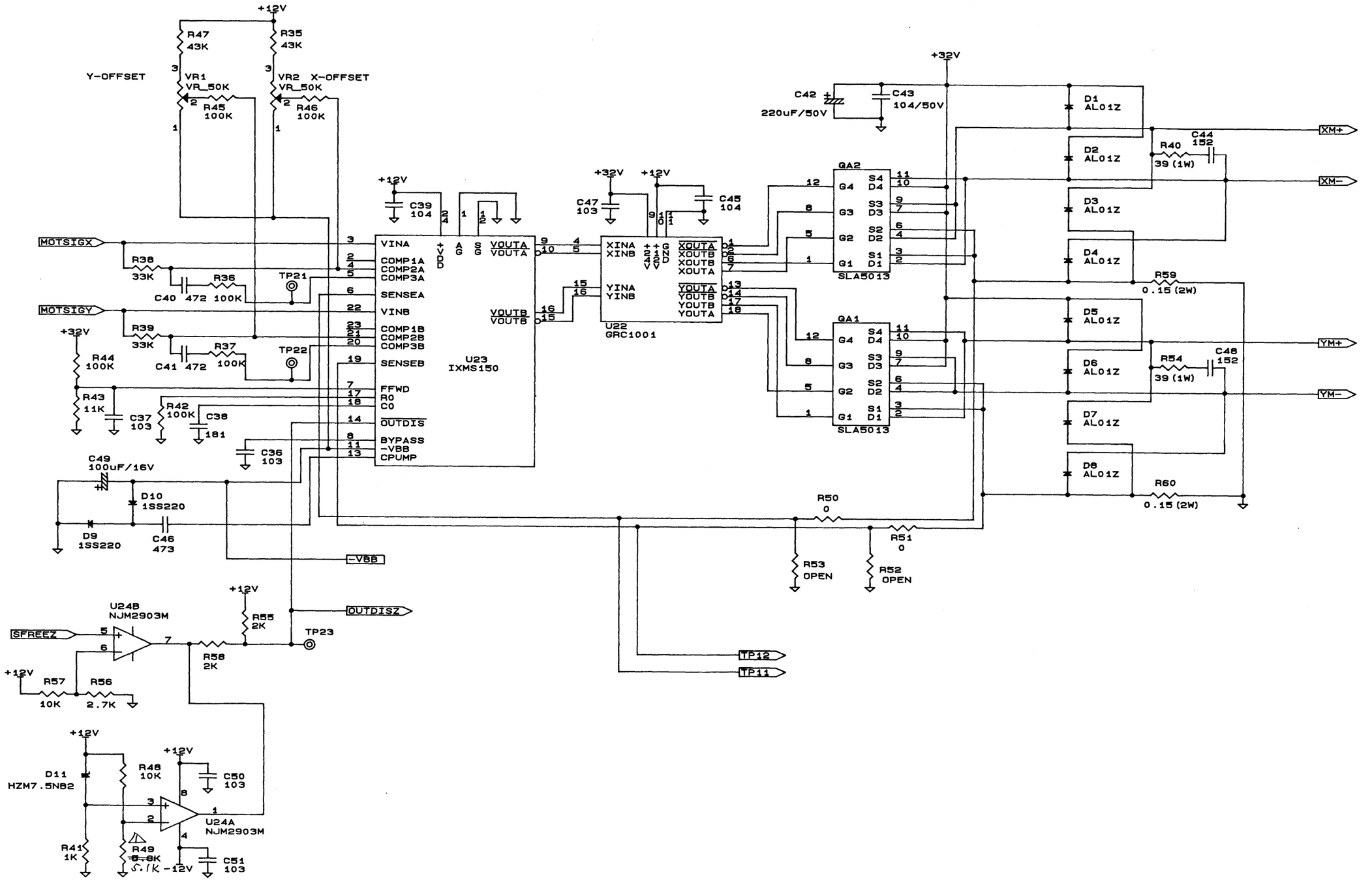
Motor DAC Section

Reference	Part Value	R201	R202
U16, 27	DAC7802	0	OPEN
U16, 27	AD7547	OPEN	0



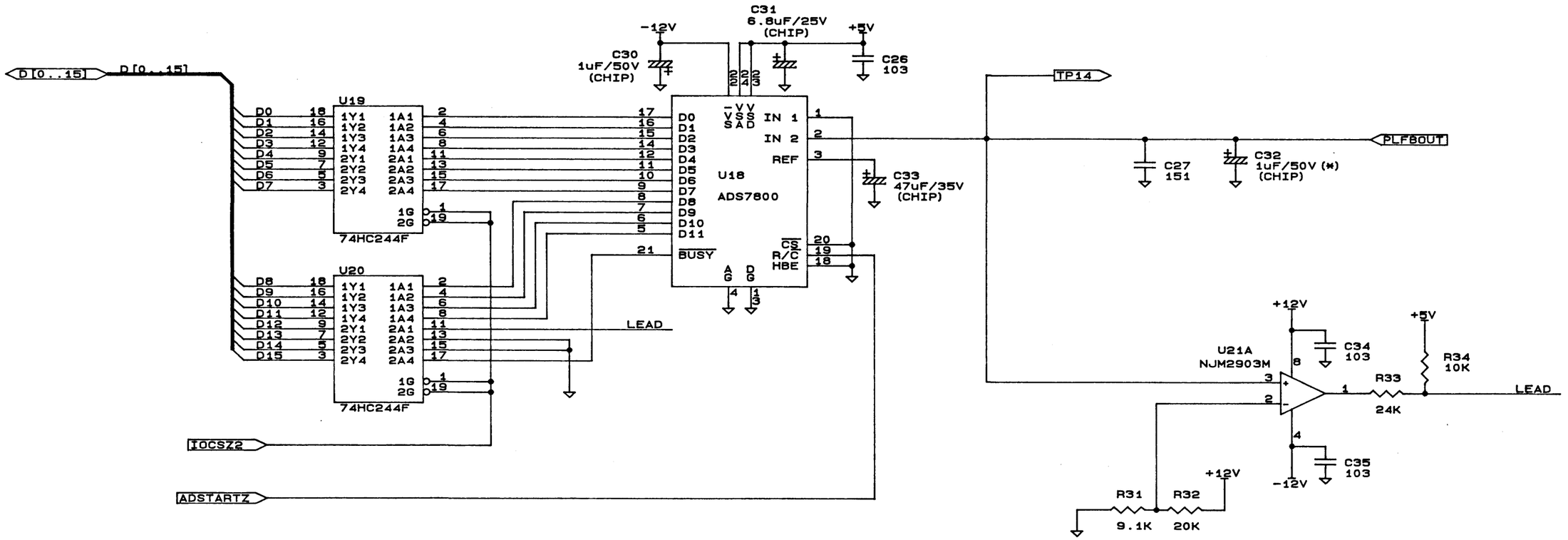
Main Board (11/17)

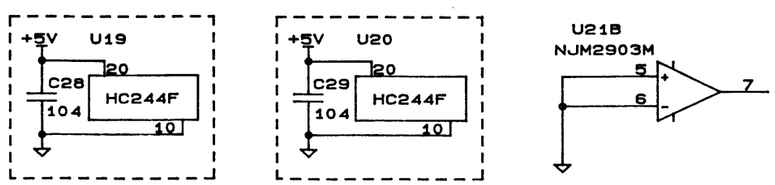
Motor Driver Section



Main Board (12/17)

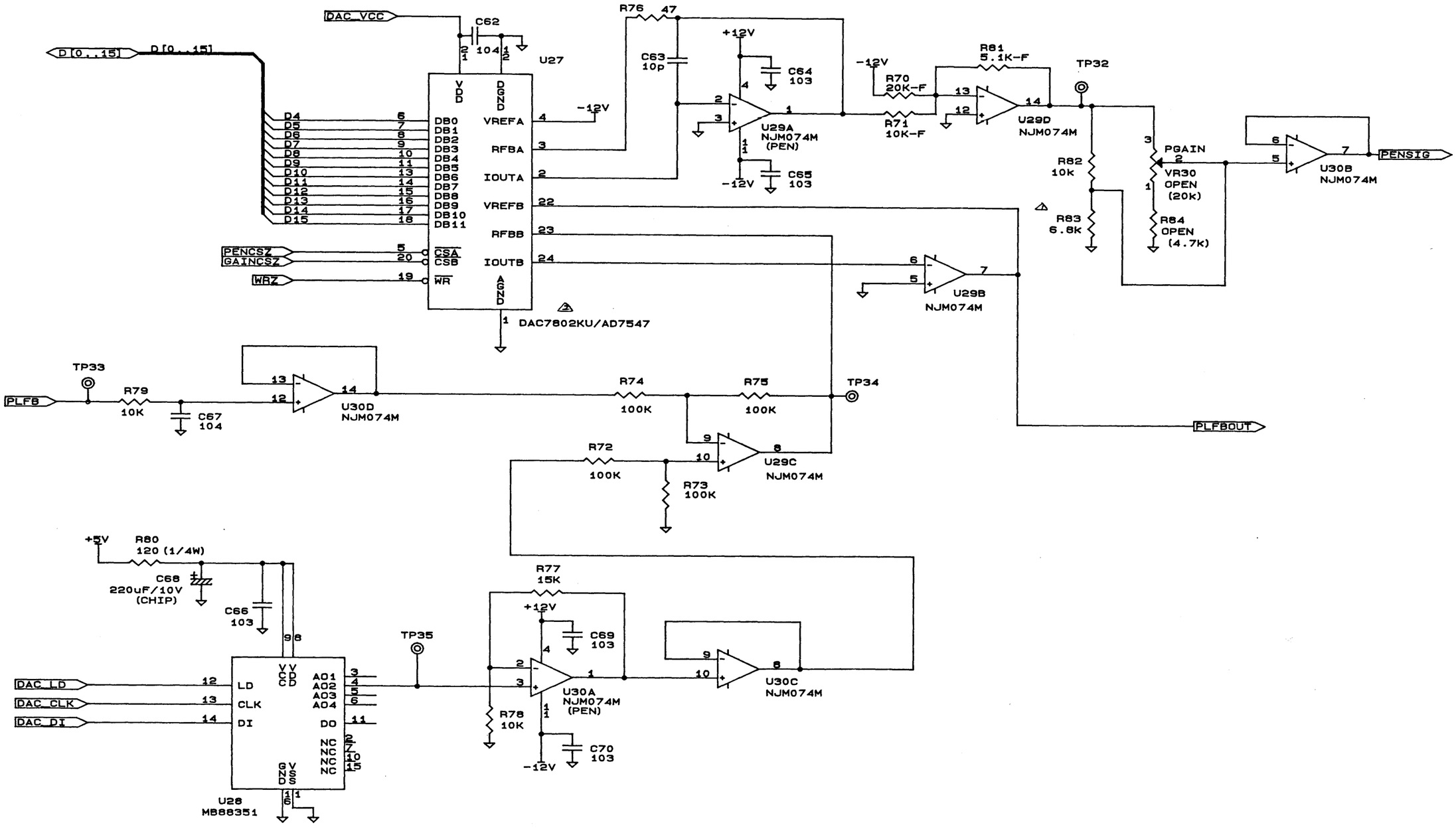
A/D Section





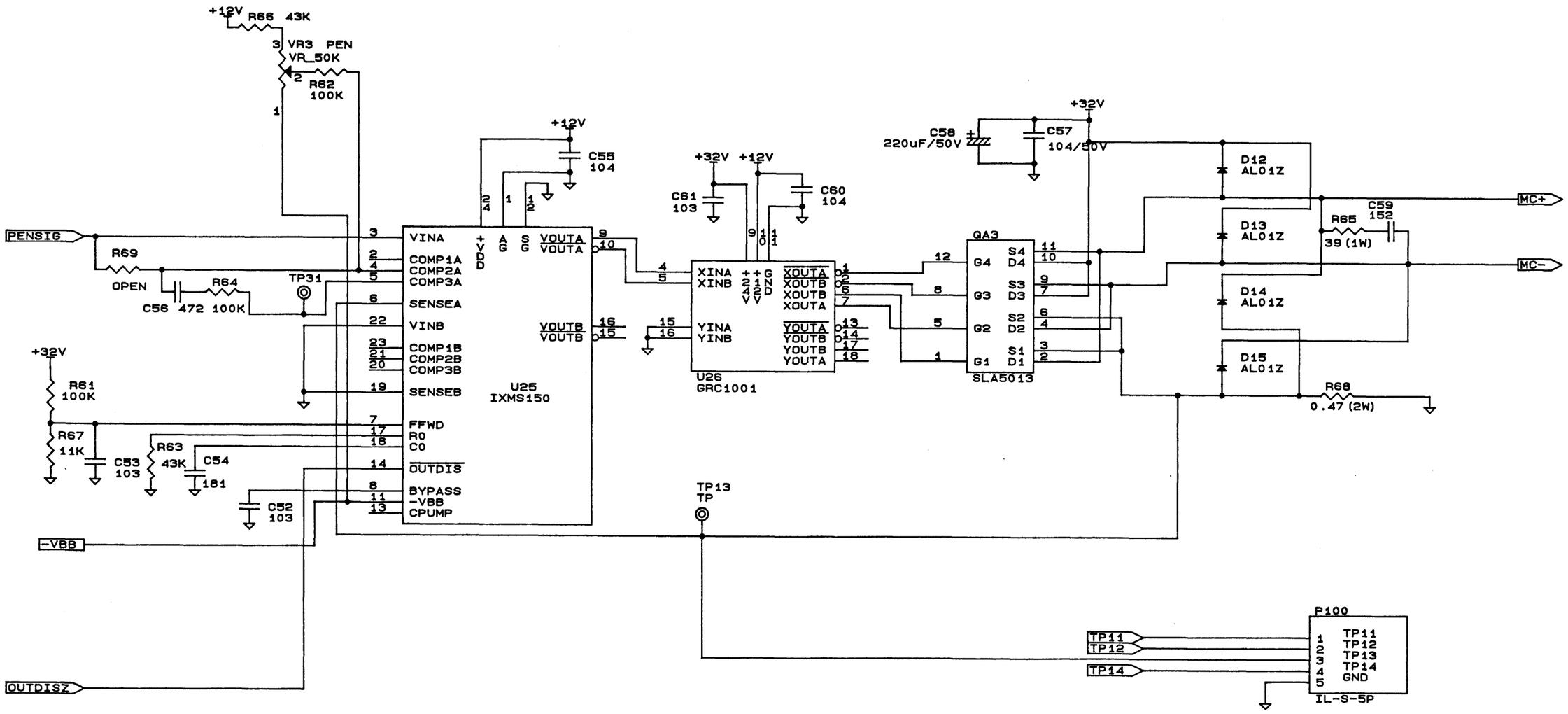
Main Board (13/17)

Pen DAC Section



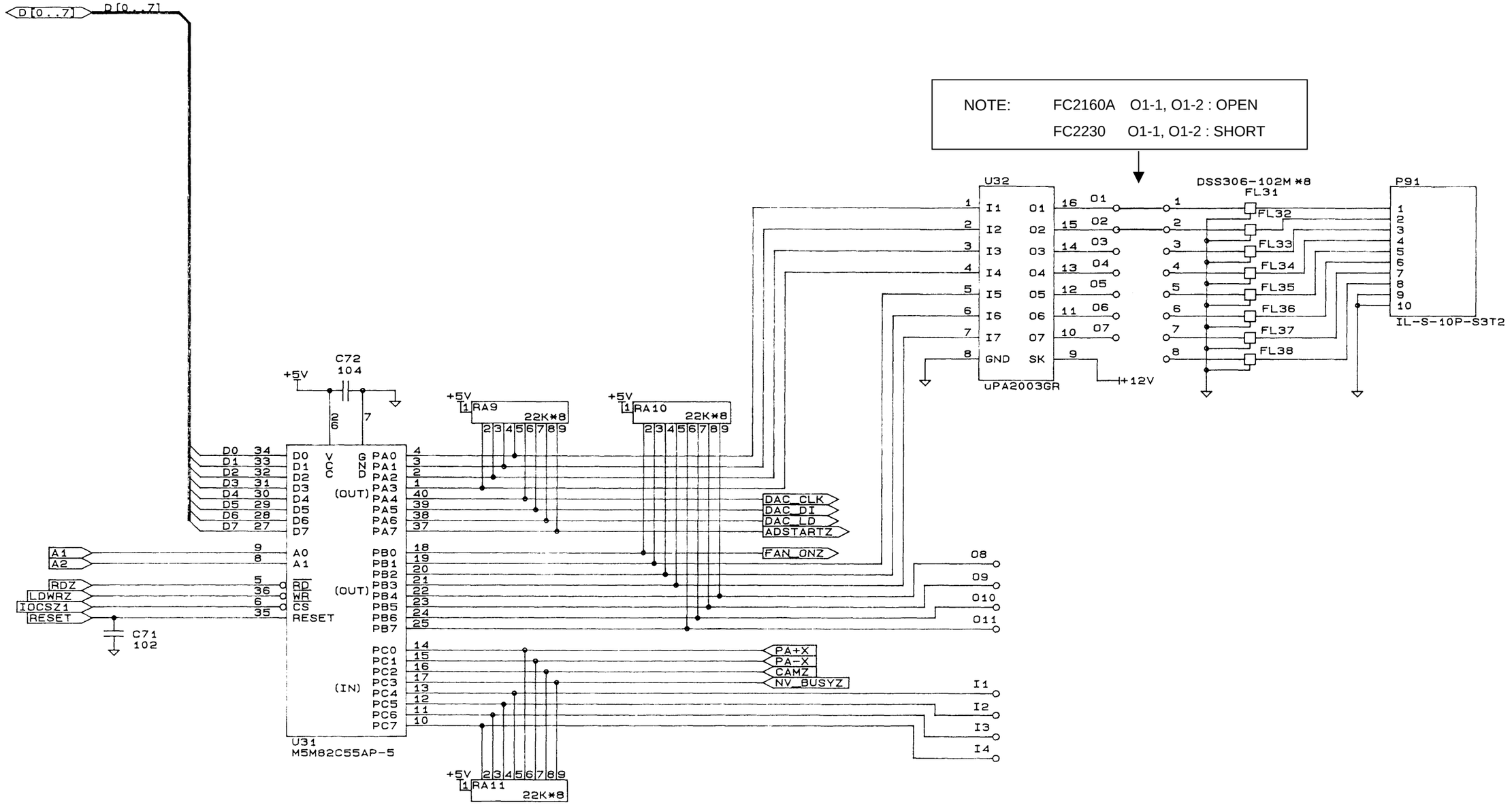
Main Board (14/17)

Pen Driver Section



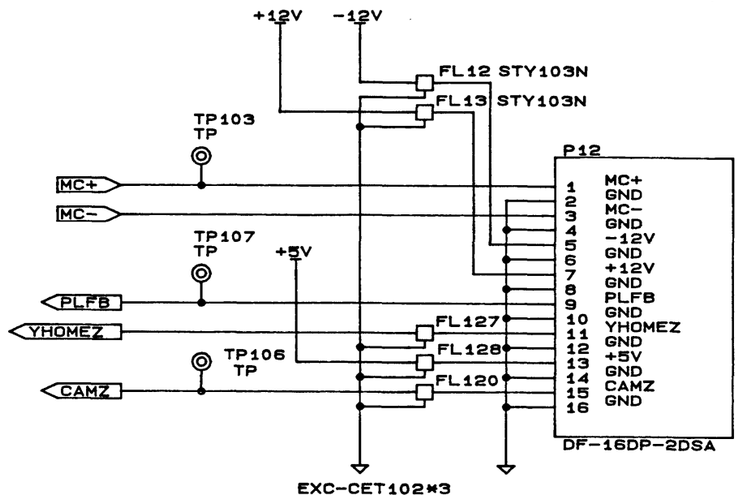
Main Board (15/17)

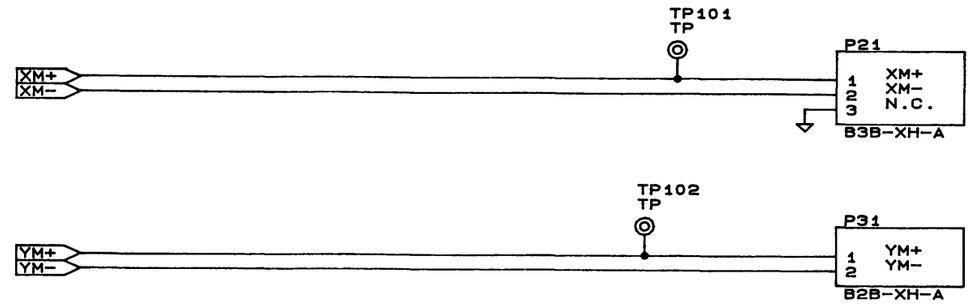
Input and Output Section

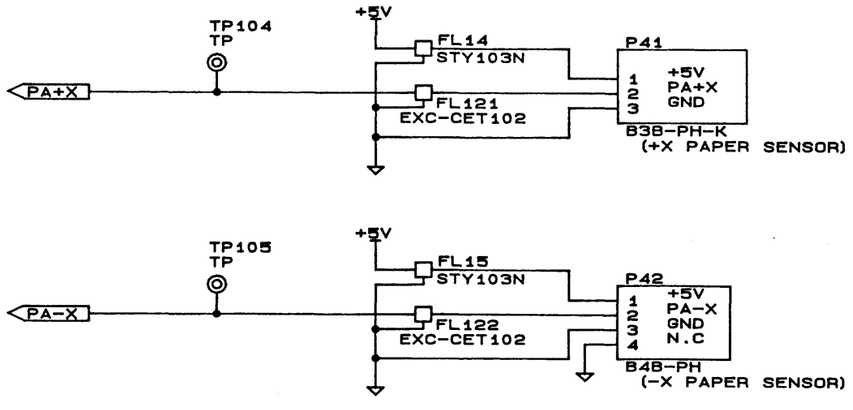


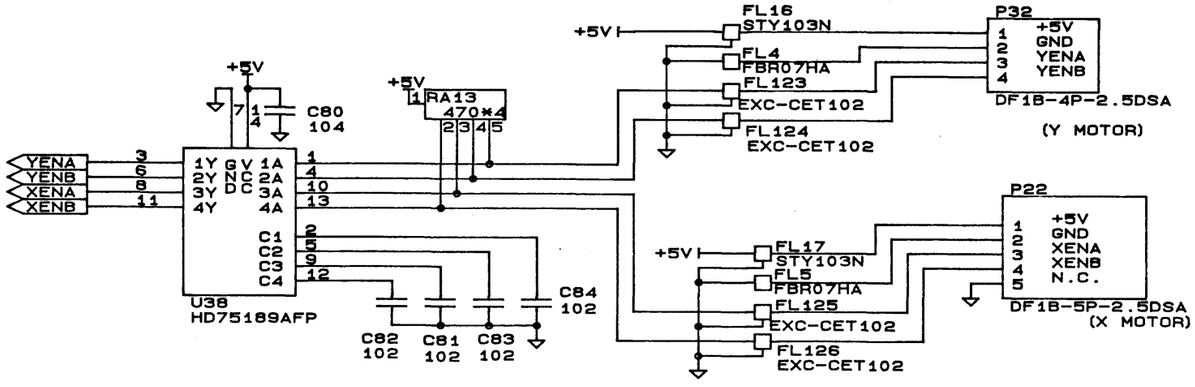
Main Board (16/17)

Connector Section 1



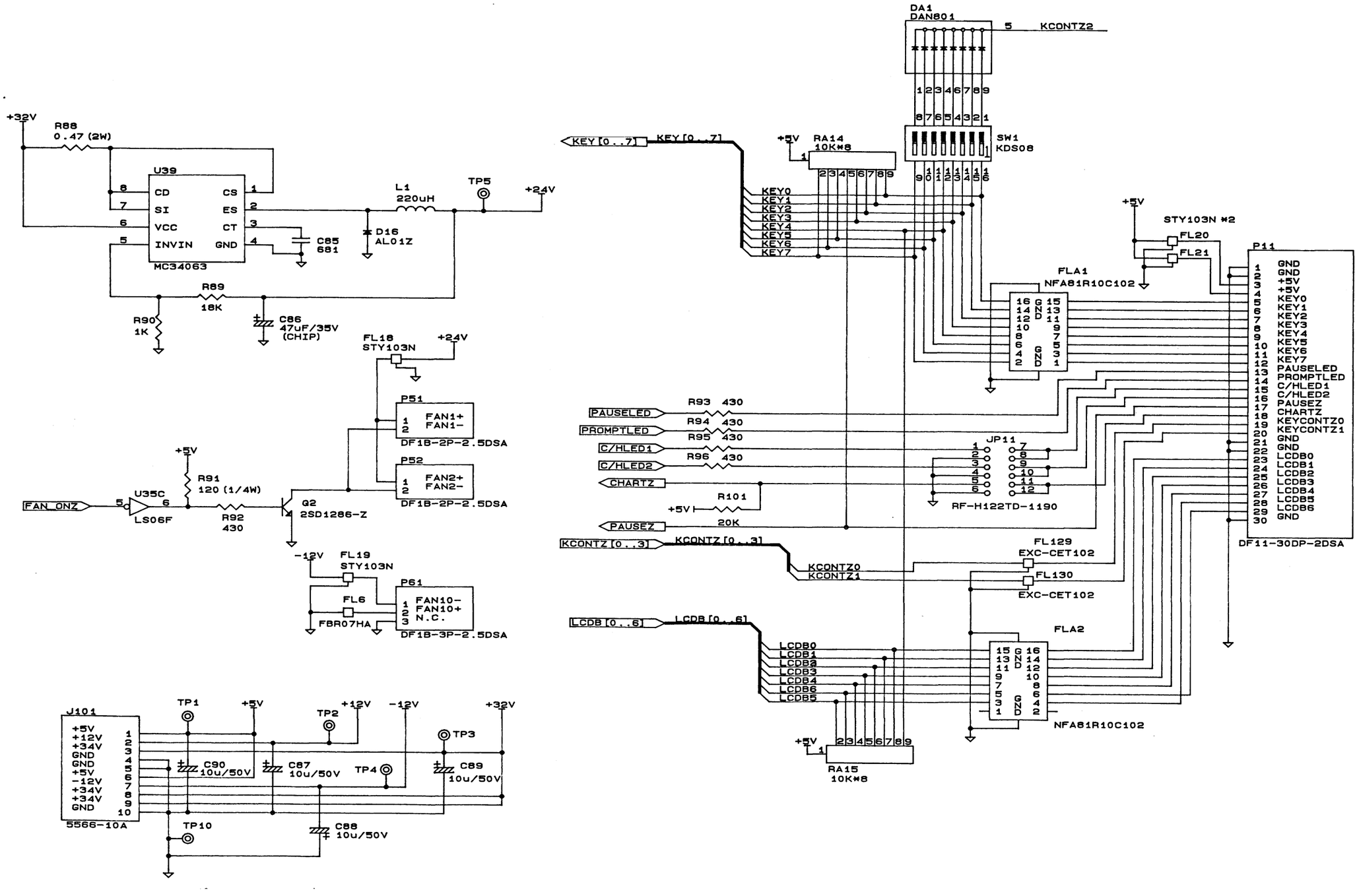






Main Board (17/17)

Connector Section 2



10-12 Miscellaneous

Circuit No.	Part No.	Description	Rating	Q'ty
	692807910	Cable	CA223201	1
	692807970	Cable	CA223207	1
	692807980	Cable	CA223208	1
	692807990	Cable	CA223209	1
	692807010	Cable	CA2232010	1
	692807020	Cable	CA2232101	1
	692807110	Cable	CA2232011	1
	692807120	Cable	CA2232012	1
	692807210	Cable	CA2232021	1
	692807220	Cable	CA2232022	1
	692807310	Cable	CA2232031	1
	692807320	Cable	CA2232032	1
	692807420	Cable	CA2232042	1
	692807090	Cable	CA2232091	1
	520100241	AC Cable	VM1182-1276.5M	
	520100330	UL/CSA AC Cable	UL/CSA Code SJT	
	500050024	CEE AC Cable	VM0306B-0304B2M	
	520000022	BS AC Cable	GRCK-B0	
	520100103	SUS AC Cable	PISEV-H05VV-F-1C	
	520100098	SAA AC Cable	SAA Standard Cable Set 3M	
	520000005	BS AC Cable(P)	Z-VCTF-OR-BS	

11. VACUUM SUCTION

11.1 Selecting the Vacuum Pump

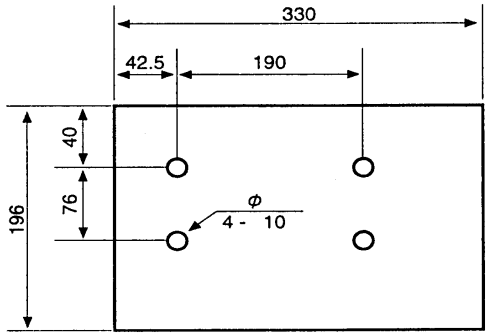
Select the vacuum pump according to the guidelines listed in the table below.

		FC2230-60VC/VCT	FC2230-90VC/VCT	FC2230-EXVC/VCT
Ratings	Airflow (m3/min)	0.3min	0.5min	0.6min
	Static pressure (kPa)	5.4min	6.4min	7.9min
Hose connection bore		38mm	50mm	50mm

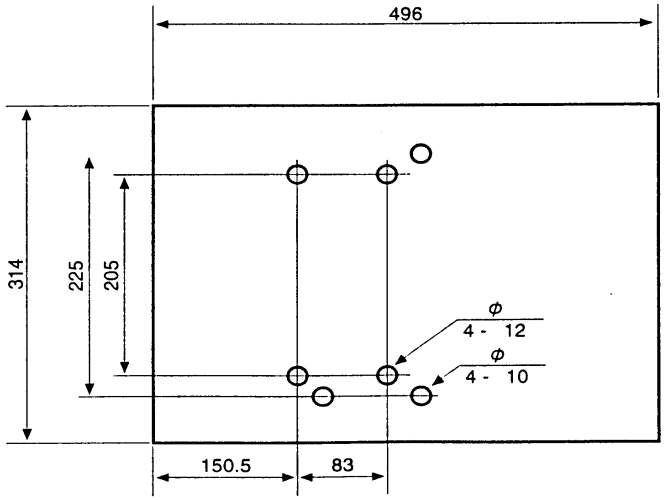
Caution: Make sure that the vacuum pump used with a VC model or a VCT model is affixed with either a label showing compliance with the relevant safety standard or with the CE marking.

The figures below show the dimensions of the vacuum pump installation base provided.

FC2230-60VC/VCT



FC2230-90VC/VCT
FC2230-EXVC/VCT

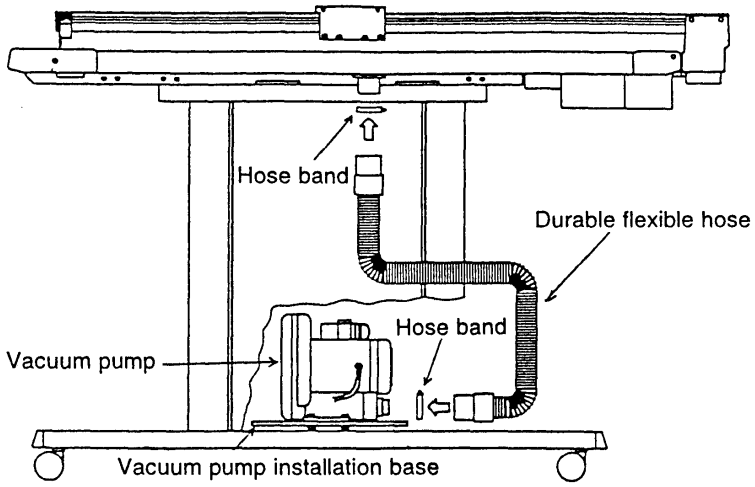


11.2 Installation Location

When connecting the vacuum pump to your cutting plotter, please refer to the following diagrams.

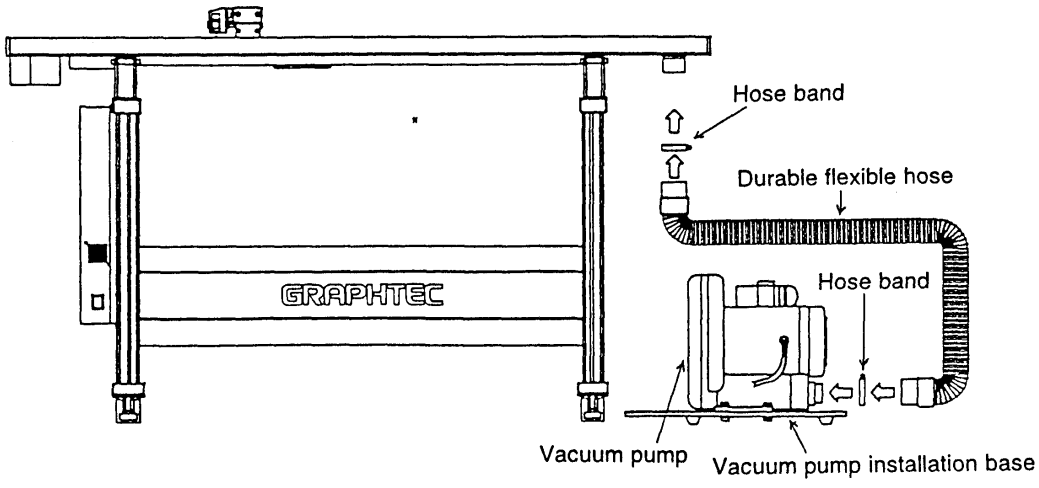
> **Caution:** The exhaust from the vacuum pump is hot, so do not place anything flammable near the exhaust port. Failure to observe this precaution could cause a fire.

FC2230-60VC/VCT



> **Caution:** A vacuum pump is not provided.

FC2230-90VC/VCT
FC2230-EXVC/VCT



> **Caution:** A vacuum pump is not provided.

11.3 Vacuum Pump Wiring

When connecting the vacuum pump to a power supply, be sure to follow the wiring instructions given in the user's manual provided with your pump.

Caution:

- Make sure that the cables and switches used for the wiring of your vacuum pump conform to the pump's rated specifications and to the safety standards of the country in which it is used.
- The pump uses a large amount of current. When connecting the pump to a power supply, be sure to confirm that the power supply you plan to use has a capacity which comfortably exceeds the amount of permissible current.
- Make sure that no foreign objects are sucked into the pump, as there is a danger that the motor will lock up and that a large amount of current will flow, causing damage to the pump and the possibility of fire.
  When connecting the pump to a power supply, make sure that there is a safety device such as a breaker or current leak alarm fitted. If required, use the safety equipment such as an air filter or auto breaker stipulated in your user's manual. Make sure that the pump is properly grounded.
- When the pump is first switched on, a large current flows which can cause malfunctioning of any computer or plotter connected to the same power supply.
  Whenever possible, avoid supplying the vacuum pump and other equipment from the same power supply.